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January 9, 2026

In Reply Refer To:
HDA-OH

ELECTRONIC CORRESPONDENCE ONLY
Pamela Boratyn, Director
Ohio Department of Transportation
1980 West Broad Street
Columbus, OH 43223

Subject: Brent Spence Bridge Corridor Project – Interchange Modification Study (IMS) Addendum Approval

Dear Director Boratyn:

In a letter dated November 21st, 2025, the Ohio Department of Transportation transmitted the Brent Spence Bridge Corridor Projects (BSBCP) Interchange Modification Study (IMS) Addendum Resubmission. The current BSBCP IMS was approved on January 11th, 2024 and subject to the completion of the project's Supplemental Environmental Assessment (SEA) for the corridor. The SEA received federal approval on May 8, 2024, and the Finding of No Significant Impact (FONSI) was issued the same day. The original corridor IMS was approved in August of 2011.

The current phase of the multi-phase corridor project is being delivered with a Progressive Design Build (PDB) procurement. Under this procurement methodology the Design Build Team (DBT) along with the project sponsors and stakeholders develop the project's final scope using a collaborative process to meet the project's purpose and need while reducing, if possible, project costs by utilizing design innovations to the original scope with the skills and strengths of the Design Build Team's engineers and contractors, sponsors and stakeholders to deliver the best possible outcome for the project using what has been termed the PDB Innovation Process.

The development of the BSBCP IMS Addenda has been a collaborative and deliberate effort by the Ohio Department of Transportation (ODOT), the Kentucky Transportation Cabinet (KYTC) and the Federal Highway Administration (FHWA) Division Offices in Ohio and Kentucky. This update and reanalysis of the previously approved BSB IMS approved in January of 2024 is required because of the changes in the project though the PDB Innovation Process. A summary of those innovations is found in Attachment A.

The Interchange Modification Study (IMS) Addendum dated November 7, 2025, regarding proposed modifications to the I-71/I-75 Brent Spence Bridge Corridor Interchanges in the cities

of Covington, Kentucky, and Cincinnati, Ohio, were reviewed and the proposed modifications are acceptable based on safety, operations, and engineering considerations.

Final approval of this access modification is given provided that the scope and design of the selected alternative in the approved environmental document is consistent with the IMS dated November 7, 2025. An environmental reevaluation was approved on 8/13/2025 and it included all the innovations in the current IMS Addenda.

This approval is subject to reevaluation if significant changes occur in the final design or if the construction is delayed (as specified in 23 CFR 771.129). Please coordinate with the FHWA Ohio and Kentucky Division Offices should further revisions be necessitated by ongoing PDB developments.

If you have any questions or comments, please contact Adam B. Johnson, Special Project Oversight Manager, at (614) 208-2193 or adam.johnson@dot.gov; or Aaron Buckner, Grants Advisor at (502) 223- 6749 or aaron.buckner@dot.gov.

Sincerely,

Shundreka R. Givan

Shundreka R. Givan, AICP
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BRENT SPENCE BRIDGE CORRIDOR PROJECT

BUILD INNOVATIONS

INTERCHANGE MODIFICATION STUDY (IMS) ADDENDUM

NOVEMBER 7, 2025

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APPENDICES

Revision Record

Rev #	Date	Description	ODOT Approval	KYTC Approval	FHWA Approval
0.1	8/22/2025	Final IMS Addendum Submittal to FHWA			
0.2	11/7/2025	Section 3.4 and Section 11.1 have been revised to clarify that the signing plan represents the current design for the Phase III segment. Appendix F has been updated to clarify the methodology of the traffic operations analysis. See Appendix F revision record for a detailed description of changes.			

1. INTRODUCTION

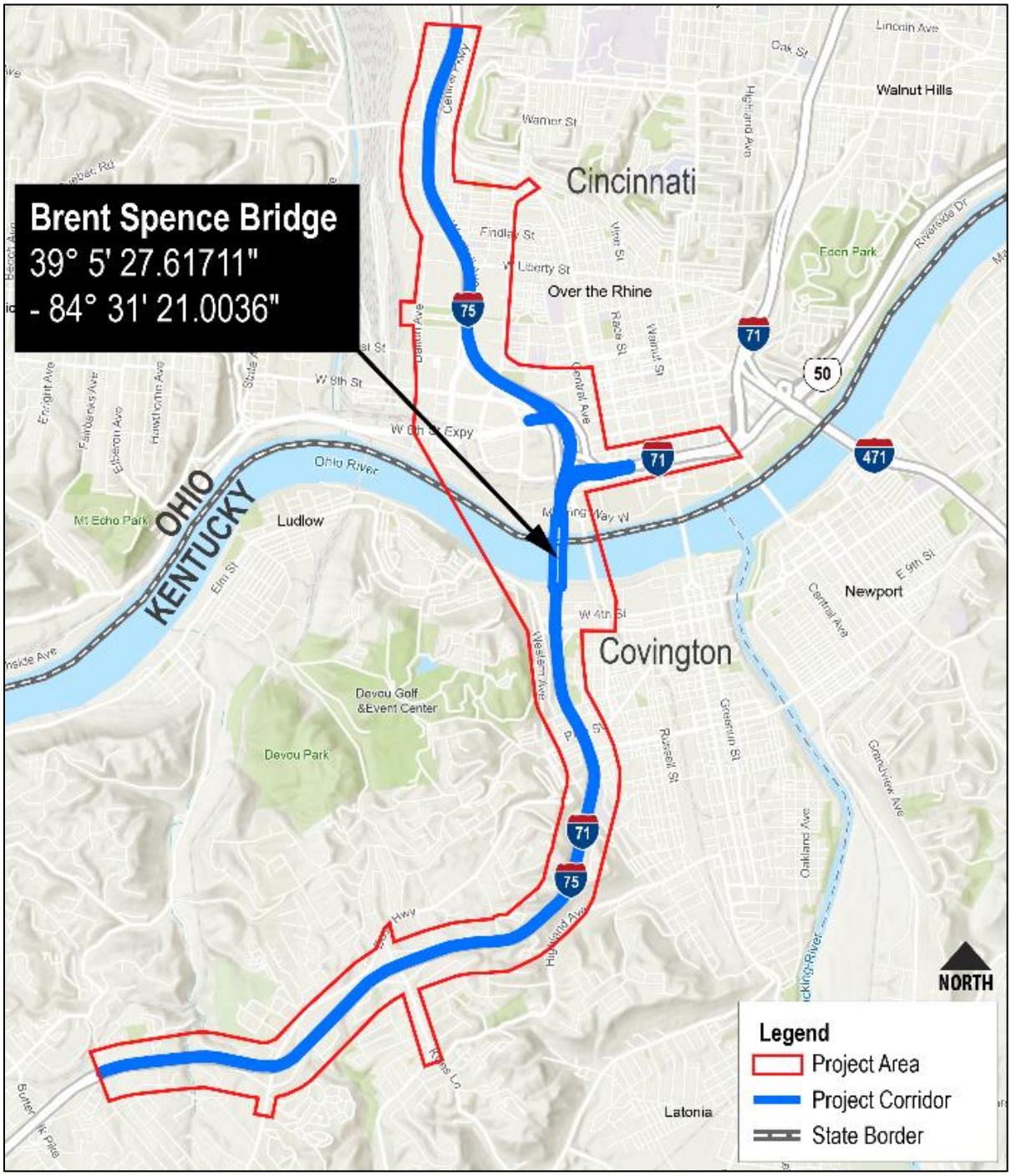
The purpose of this *Interchange Modification Study (IMS) Addendum* is to update the IMS (December 2023)[1] for the Brent Spence Bridge (BSB) Corridor project. This IMS Addendum provides information related to design and traffic analysis performed since 2023. These collective refinements incorporated into Refined Alternative I (Concept I-W) are called Build Innovations throughout this IMS Addendum. The addendum will assist the Kentucky Transportation Cabinet (KYTC), the Ohio Department of Transportation (ODOT), and FHWA in assessing the differences in impacts to safety and mobility between the Refined Alternative I (Concept I-W) and the refinements incorporated into Build Innovations and provide the justification and documentation necessary to substantiate that these refinements will not result in adverse impacts to operations or safety.

2. PROJECT AREA AND STUDY AREA

Figure 1 illustrates the BSB project area and interstate I-71 and I-75 corridor, including geospatial data for the bridge crossing. The southern limit of the project is approximately 5,000 feet south of the US 25/Dixie Highway interchange on I-71/I-75 in Fort Mitchell at Kentucky milepost 187.6. The northern boundary of the project is about 1,500 feet north of the Western Hills Viaduct (WHV) interchange on I-75 in Cincinnati at Ohio milepost 2.5. The eastern and western limits of the project corridor generally follow the existing alignment of I-75, a major thoroughfare for local and regional mobility within the Greater Cincinnati/Northern Kentucky region. Locally, I-75 connects to I-71, I-74, I-275, and US Route 50. The BSB provides an interstate connection carrying I-71 and I-75 over the Ohio River, providing a critical link along the national I-75 corridor stretching from Florida to Michigan.

[1] https://brentspencebridgecorridor.com/wp-content/uploads/2024/01/2023-12-08_-IMS-Compiled.pdf

Figure 1: BSB Project Area



The BSB Study Area for this IMS Addendum extends to the first adjacent interchange beyond the project area, including Buttermilk Pike south of the US 25/Dixie Highway Interchange and Hopple Street north of the WHV Interchange. **Figure 2** shows the TransModeler operations limits extend along the I-71/75 corridor to include the I-275 Interchange on the south and the I-74/I-75 Interchange on the north. The model includes mainline, ramps, ramp terminals, and arterial intersections.

Figure 2: TransModeler Project Limits

3. PROJECT DESCRIPTION

3.1 Overview

The primary project elements remain unchanged since the 2023 IMS addendum. The project will widen 7.8 miles of I-71/I-75 from south of Dixie Highway in Kentucky to the Western Hills Viaduct (WHV) in Ohio and rebuild all bridges and interchanges. A collector-distributor (C-D) system will be added between 12th Street in Kentucky and Ezzard Charles Drive in Ohio. A C-D system is a network of roads alongside a highway that "collects" traffic exiting from a highway and "distributes" it to local roadways. It also "collects" traffic from local roadways and "distributes" it onto the highway. The primary features of the project include:

- Reconstructing I-71/I-75 and adding one lane in each direction;
- Rebuilding the overpass bridges and interchanges in the corridor and adding a new exit at Ezzard Charles Drive in Ohio;
- Constructing a C-D roadway system between West 12th Street/Martin Luther King (MLK) Jr. Boulevard in Kentucky and Ezzard Charles Drive in Ohio;
- Extending frontage roads connecting Pike Street to West 4th Street and West 5th Street in Kentucky;
- Adding C-D lanes between Dixie Highway (US-25) and Kyles Lane (KY-1072) in Kentucky;
- Rehabilitating and reconfiguring the existing double-decker BSB to carry three lanes of local traffic on each deck as part of the C-D roadway system and
- Building a new double-decker companion bridge west of the existing BSB to carry five lanes of through (interstate) traffic on each deck.

3.2 Purpose and Need

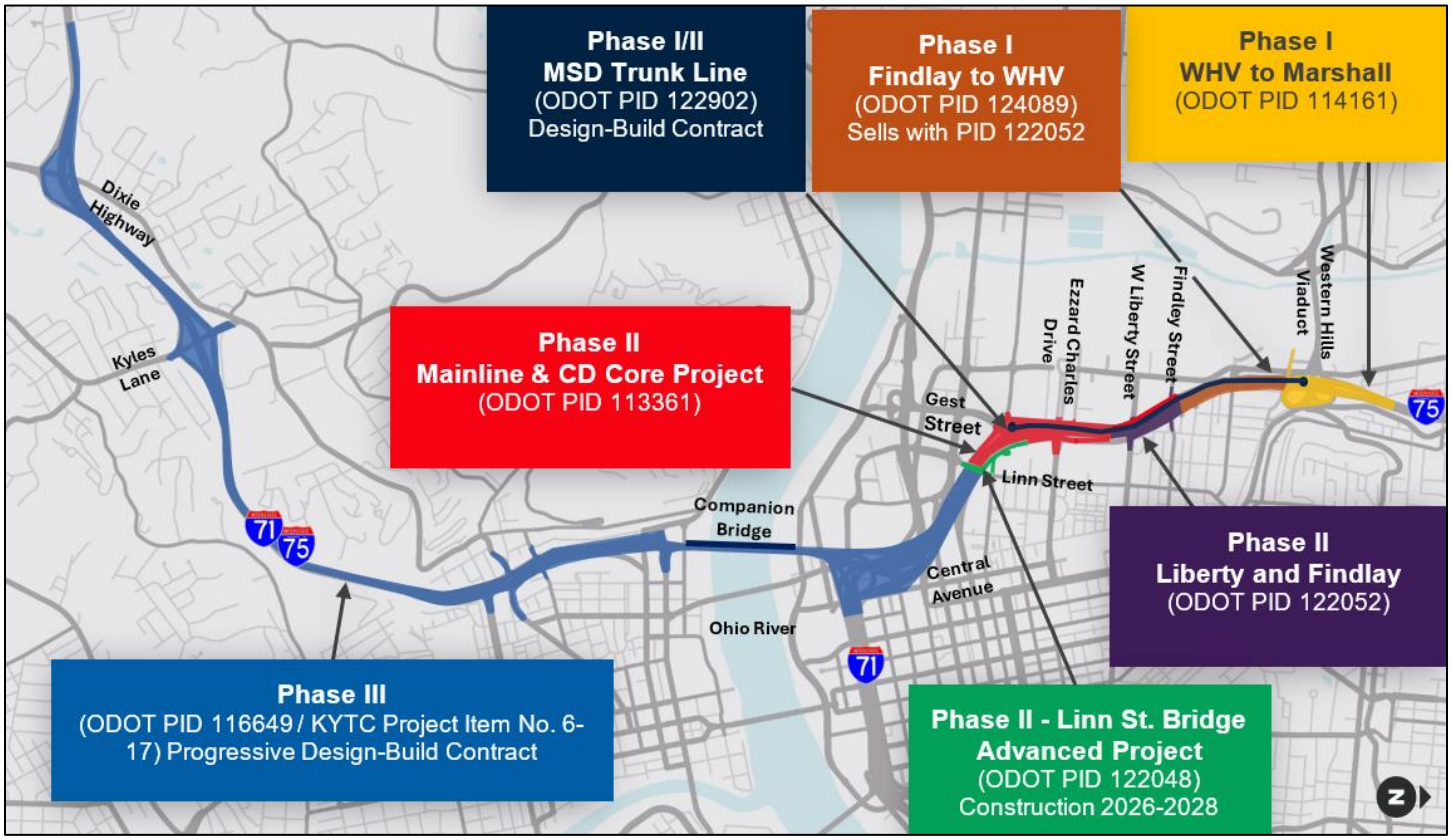
The purpose of the BSB Corridor Project is unchanged from what was presented in the approved May 2024 SEA/FONSI:

- Improve traffic flow and level of service.
- Improve safety.
- Correct geometric deficiencies.
- Maintain connections to critical regional and national transportation corridors.

3.3 Project Phasing

The project is currently intended to be delivered in three non-sequential construction phases (Phases I–III) with some identified and developed subphases as shown in **Figure 3**. As Phases I-III are fully developed, subphases may be added or consolidated depending on the progress of the work and other considerations.

Figure 3: BSB Corridor Phasing



3.3.1 Phase I (ODOT PID 114161)

ODOT has a contract for the design of the interstate and interchanges in this corridor segment from Findlay Street to the north of the WHV, which includes coordination with the design of the WHV. The WHV will be replaced, and a new interchange will be designed to ensure local and interstate connections. The City of Cincinnati and Hamilton County lead the WHV project. This Phase I work will follow a Design-Bid-Build process with construction coordinated with the WHV. The design of this segment has not changed since the 2023 IMS addendum.

3.3.2 Phase II (ODOT PID 113361)

ODOT has a contract to design the interstate and interchanges from Linn Street to Findlay Street in this corridor segment. This Phase II work will follow a Design-Bid-Build process. Segments of Phase II construction have been subdivided with an anticipated contract award for new PID 122048 (Linn Street) in October 2025. The advanced sale will better accommodate the tie-in with Phase III. Coordination continues with the Phase III design team in evaluating innovations affecting Phase II. Roadway designers for Phases II and III continue to meet and share alignments as part of coordination efforts. The design of this segment has been advanced

since the 2023 IMS addendum, but mostly remained unchanged. Some traffic volume differences occur due to access changes in the Phase III segment. **Table 1** provides a summary of Phase II sub-phases.

Table 1: BSB Phase II Sub-phases

PID	CRS	Contract Award		Estimated Cost (millions)	Description
		Date	FY		
113361	HAM-75-1.05	Oct-2029	30	$441.0	Core Phase II mainline and CD project includes a design contract for all four sub-phases
122048	HAM-75-1.05	Oct-2025	26	$61.1	Linn Street advance project (construction only)
122052	HAM-75-1.67	Oct-2030	31	$85.4	Liberty & Findley w/ some mainline (construction only)
122902	HAM-75-1.25	Jul-2027	28	$62.6	MSD trunk line from Gest Street to Western Hills Viaduct (construction only)

3.3.3 Phase III (ODOT PID 116649/KYTC Project Item No. 6-17)

Phase III includes all work from Dixie Highway in Kentucky to Linn Street in Ohio, including constructing the new companion bridge and rehabilitating the existing BSB bridge. This phase will follow a Progressive Design-Build Process. All design changes since the 2023 IMS addendum are within this project phase.

3.4 Design Criteria

The Build Innovations design follows the current versions of the KYTC *Highway Design Guidance Manual* and the ODOT *Location and Design Manual*. There have been no changes since 2023 with the approval of Refined Alternative I (Concept I-W).

Final plans will be current with all design standards for the currently approved KYTC Highway Design Guidance Manual and/or the ODOT Location and Design Manual which meet the current AASHTO Standards.

Appendix A presents a conceptual signing plan for Build Innovations. This preliminary design illustrates the general types and locations of signs intended to support the proposed design alternative. While the conceptual plan does not currently comply with the Manual on Uniform Traffic Control Devices (MUTCD), all traffic control devices installed on publicly traveled roadways will be fully compliant at the time of project delivery. The engineer of record and project delivery team will ensure adherence to all applicable standards. It is important to note that the conceptual signing plan is for the Phase III design segment. The plan contains the existing roadway geometry for Phases I and II, which will be constructed after Phase III. Phases I and II do not contain major geometric changes since the 2023 IMS addendum.

3.5 Description of Alternatives

ODOT and KYTC identified Selected Alternative I as the preferred Alternative in the BSB 2012 EA/FONSI. Refined Alternative I (Concept I-W) was developed as a value engineering refinement to Selected Alternative I through design and operational studies completed between 2012 and 2023. Build Innovations alternative includes enhancements to Refined Alternative I (Concept I-W) within phase III of the project corridor. This IMS addendum compares Refined Alternative I (Concept I-W) to Build Innovations. These two alternative designs are described in the following sections.

3.5.1 Refined Alternative I (Concept I-W)

Refined Alternative I (Concept I-W) uses the Selected Alternative I alignment and design from the Dixie Highway Interchange to KY 12th Street and includes a C-D on both sides of I-75 north of US 50 in Ohio with access restrictions similar to those in Selected Alternative I.

In Refined Alternative I (Concept I-W), a companion bridge (with a width of 107 feet) is proposed just west of the existing BSB with all I-71 and I-75 traffic on the new bridge and all C-D traffic on the existing BSB. The new bridge will carry five lanes of SB I-71 and I-75 traffic on the lower deck and five lanes of NB I-71 and I-75 traffic on the upper deck. The existing BSB will be rehabilitated and restriped from four lanes to three lanes on each deck for NB C-D traffic on the lower deck and SB C-D traffic on the upper deck as part of the C-D roadway system. See **Appendix B** for the Refined Alternative I (Concept I-W) Plan.

3.5.2 Build Innovations

Public engagement during the SEA development was meant to drive further innovations and design refinements. In February 2024, during the public review period of the SEA, public comments were received that guided the project team in the innovation process, including the ideas of reconnecting communities and improving public safety. The innovation process aimed to identify ways to support project goals, enhance the quality of the project, reduce costs, shorten the schedule, support project goals, and ensure that refinements have support at the local level. The innovations developed and considered included a wide range of concepts, many with minor adjustments and some with bigger refinements. Innovations focused on different outcomes; some were intended primarily as cost-saving measures, while others were developed in response to ideas from local municipalities and public comments and focused more on furthering project goals.

The BSB Corridor Design-Build Team (DBT) identified and explored 117 potential innovations for Phase III. Among these was the fulfillment of Environmental Commitment 51 from the 2024 FONSI, which required the evaluation of several refinements proposed during public involvement for the SEA. The refinements include:

1. Eliminating the 3rd Street ramp to the northbound collector-distributor (C-D) system in Cincinnati and redirecting traffic to the proposed connection at the end of the Clay Wade Bailey Bridge;
2. Reconfiguring the lanes on the Clay Wade Bailey Bridge to add bicycle lanes;
3. Reconfiguring 6th Street in Cincinnati to accommodate two-way traffic; and
4. Considering design concepts submitted by the Bridge Forward Coalition.

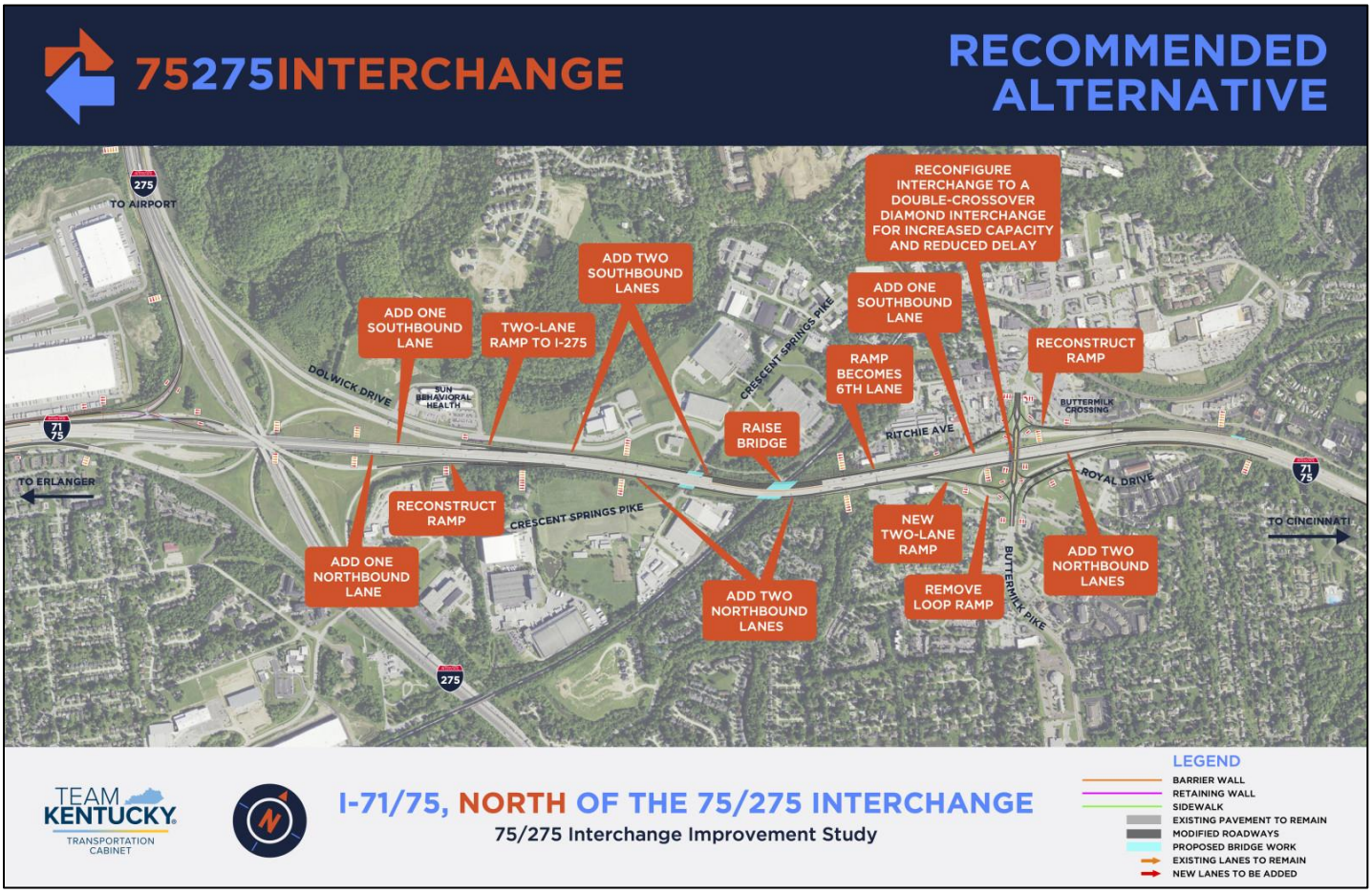
As a result of the innovation process, 26 of the 117 identified innovations were recommended to be incorporated into the project at this time. The formal Innovation phase has concluded; however, additional innovations and design progression may be developed and incorporated as the phases and final plans progress to implementation and construction.

The 26 recommended innovations can be grouped into three significant innovations in Kentucky and four major innovations in Ohio, which are described below. On May 28, 2024, the Federal Highway Administration concurred with developing these innovations as part of the Phase III progressive design-build contract. These seven innovations and a detailed design modification for Kentucky are discussed in **Section 4.**

3.6 Adjacent Projects

Improvements to I-75 between Turfway Road and the southern limits of the BSB Corridor project, including the I-275 and Buttermilk Parkway Interchanges, are identified in the OKI Metropolitan Transportation Plan and are currently in the NEPA development phase at KYTC. These safety and capacity improvements are anticipated to be phased between 2027 and 2035, pending funding authorization by the KY General Assembly. The recommended alternative for the north segment of this project is detailed in Figure 4. These roadway improvements are included in the 2049 operations analysis summarized in the BSB IMS addendum. A traffic operational sensitivity analysis was completed for BSB opening year 2029 and design year 2049 to evaluate I-71/I-75 operations for Refined Alternative I (Concept I-W) without the inclusion of this project. The sensitivity analysis indicated that the completion of this project is critical for the efficient operations of I-71/I-75 between the BSB and I-275 Interchange.

Figure 4: I-275 Project – North Segment Recommend Alternative



4. LOCATIONS OF NOTABLE CHANGE

The Build Innovations alternative has incorporated 26 innovations broadly grouped into seven innovation areas, four in Ohio and three in Kentucky. Additionally, a detailed design modification for Kentucky is included in the list of notable changes. This section provides an overview of these design changes, while subsequent chapters will discuss their impacts on traffic demand, operations, and safety.

4.1 Ohio Innovation 1 (OH 1): SB I-71/75 Roadway Reconfiguration

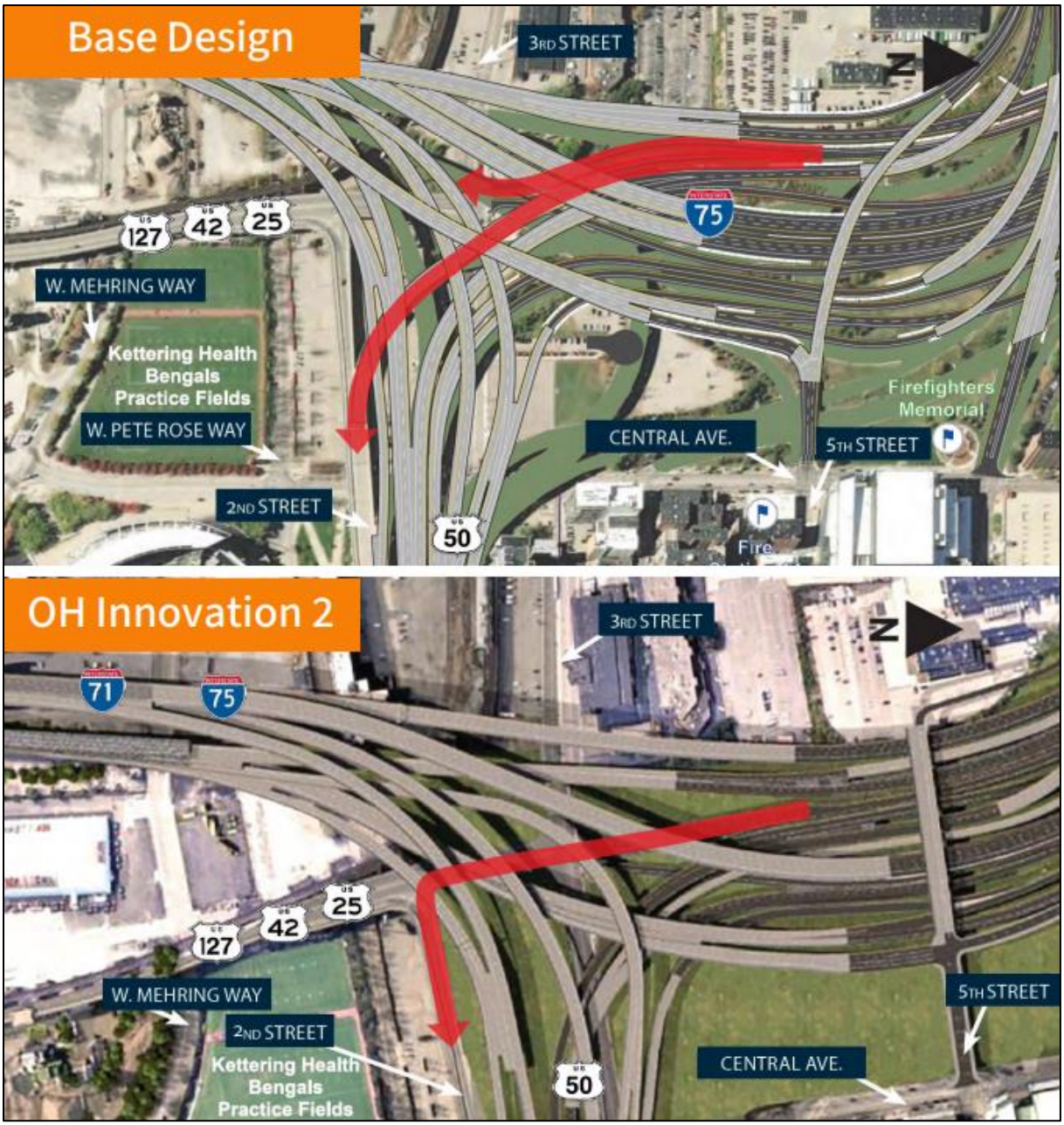
OH 1 relocates southbound I-71/I-75 to the outside lane (blue lane in **Figure 5** below), and the southbound C-D system is placed to the inside (green lane in **Figure 5** below). This allows for safer construction of the project by constructing southbound I-75 offline, simplifying complicated bridge designs, and simplifying traffic maintenance, resulting in overall improved constructability and safety. The southbound roadway reconfiguration will eliminate the SB I-75 entrance ramp from Western Avenue. This movement will be rerouted about 0.6 miles to the proposed 9th Street entrance or 1.25 miles to the existing Freeman Avenue interchange.

Figure 5: SB I-75 Roadway Reconfiguration

4.2 Ohio Innovation 2 (OH 2): Combination of 2nd and 3rd Street Connections

OH 2 combines the SB I-75 ramps to the 2nd and 3rd streets to reduce vertical design challenges in the interchange, enhance the grid street system, improve safety at the 2nd Street and Elm Street intersection, and reduce impacts to the City of Cincinnati parking lots. As indicated in **Figure 6**, traffic is rerouted through upgraded at-grade intersections at 3rd and 2nd streets, which reduces costs by reducing bridge deck area and improves constructability.

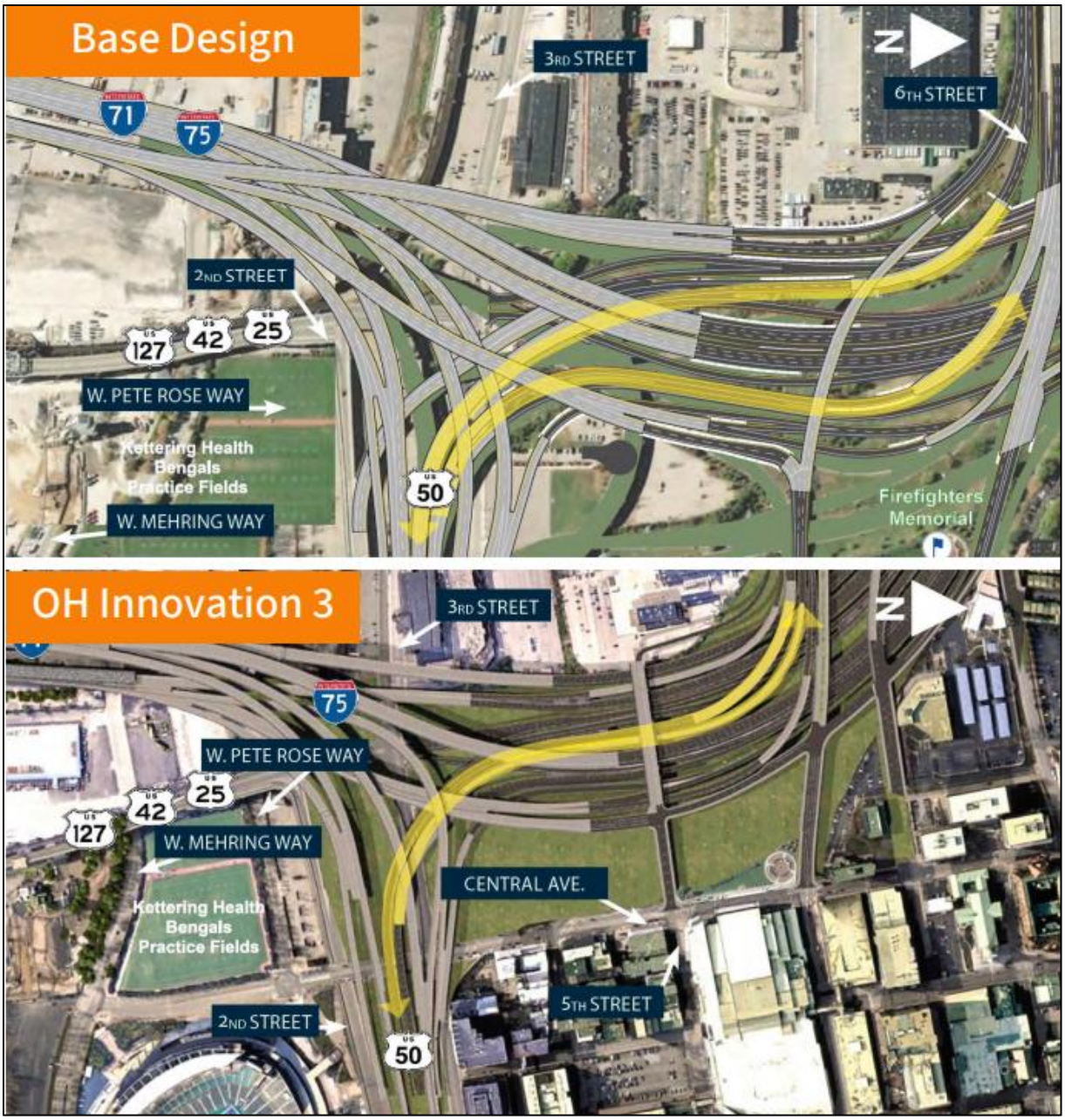
Figure 6: Combination of 2nd and 3rd Street Connections



4.3 Ohio Innovation 3 (OH 3): US-50 Roadway Consolidation

OH 3 reconfigures the eastbound and westbound US 50 movements to follow a single alignment (**Figure 7**). Consolidating the US 50 roadways reduces the footprint of the US 50 through movement. It also provides improved geometrics for the tie-in movements of the C-D roads and local streets and allows for the future expansion of 5th Street west to Gest Street, which the City of Cincinnati requested. With this innovation, the ramp from westbound US-50 to Gest Street is removed, and traffic is rerouted to the existing Linn Street exit.

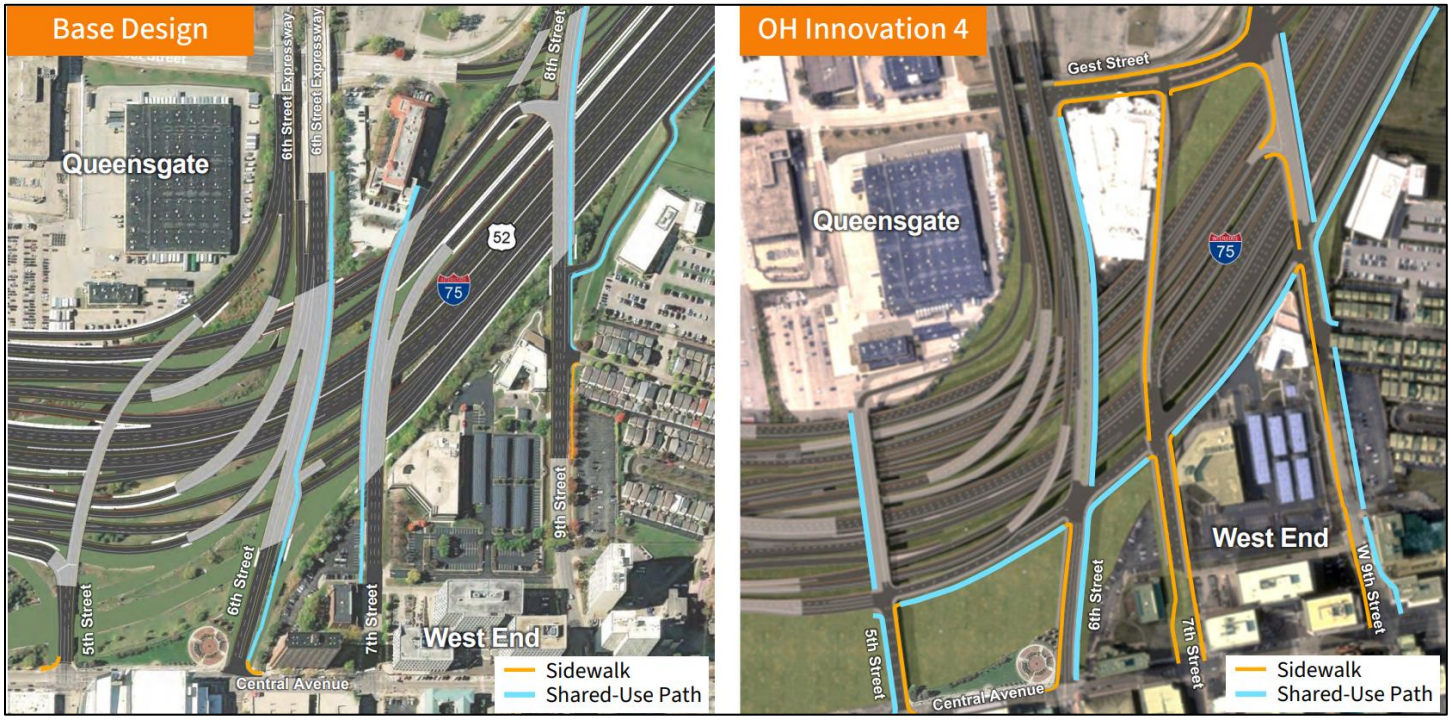
Figure 7: US 50 Roadway Consolidation



4.4 Ohio Innovation 4 (OH 4): The Realization of the Street Grid

OH 4 reconnects the street grid across the 3rd, 5th, 6th, 7th, and 9th streets, enhancing connectivity for all modes of travel. The innovation shortens the pedestrian crossing from downtown Cincinnati to Queensgate by at least 1,100 feet and condenses the interchange footprint, creating additional developable land in combination with OH 3. The realization of the street grid and the additional developable land meets the goals of the Bridge Forward Coalition's design concepts and stakeholder comments provided by the City of Cincinnati. The design of innovation OH 4 is shown in **Figure 8**.

Figure 8: Realization of the Street Grid



4.5 Kentucky Innovation 1 (KY 1): Vertical Profile Optimization

KY 1 optimizes the vertical profile of I-71/I-75. To do this, the southbound collector-distributor (C-D) road from Refined Alternative I (Concept I-W) is reconfigured to move the existing Brent Spence Bridge C-D exit further south and braid the C-D road over the mainline lanes. The southbound (SB) local movement on the C-D will remain on the east side of northbound (NB) I-75 until south of 5th Street, where it then crosses I-75 to diverge to the SB frontage road and SB I-75. This movement is shown in **Figure 9**. By shifting where the SB C-D road crosses I-75, the NB I-75 vertical profile is lowered by approximately 20 feet, and an interchange level between 4th and 5th streets is eliminated. KY 1 also adjusts West 5th Street to better integrate traffic into Covington by closing West 5th Street between Crescent Avenue and Simon Kenton Way and redistributing traffic to West 3rd Street. The closure of the West 5th Street underpass also accomplishes the following:

- Eliminates a bridge over Bullock Street.

- Improves the grade and reduces retaining walls on Bullock Street.
- Shortens the mainline overpass structures.
- Allows for more substantive improvements at the Crescent Avenue and West 3rd Street intersection to accomplish the City of Covington's desire to establish a "gateway" entrance into the riverfront area at Crescent Avenue/West 3rd Street.

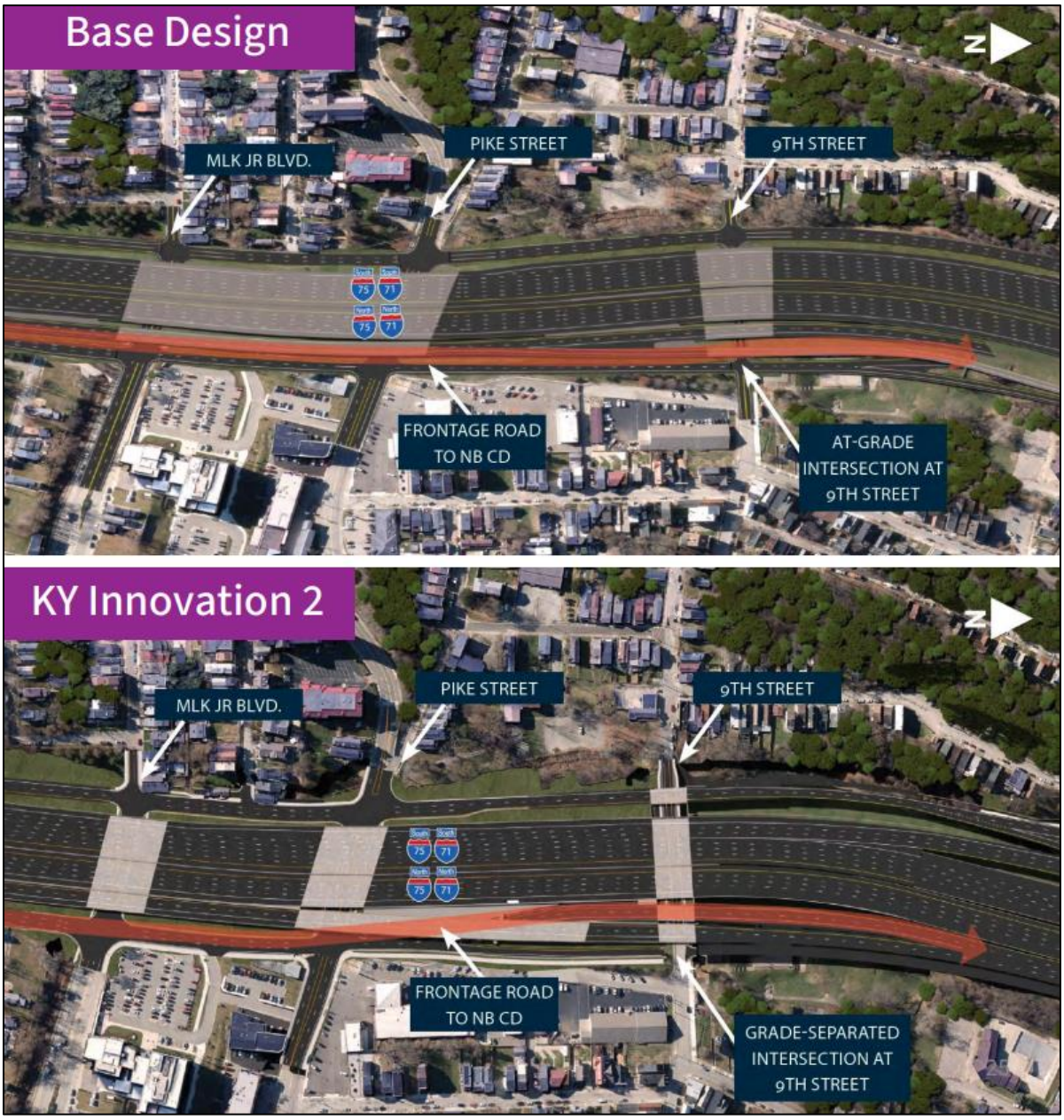
Figure 9: Vertical Profile Optimization

4.6 Kentucky Innovation 2 (KY 2): Pike Street Access Optimization

As shown in **Figure 10**, Refined Alternative I (Concept I-W) included revising the current access in Covington to provide a new frontage road system, both NB and SB, connecting MLK Jr. Boulevard, Pike Street, 9th Street, 4th Street, and 5th Street. With this alternative, the primary access to and from the interstate was relocated from Pike Street to 9th Street. Based on certified traffic, the relocation of interstate access from Pike Street to 9th Street redistributes traffic in Covington. It adds substantial traffic to 9th Street, effectively making it a primary cut-through for traffic entering and exiting the freeway. The braided ramp configuration for traffic entering the freeway from Covington with traffic heading NB on the C-D system heading to 5th Street also has a tall, wide footprint that introduced substantial impacts to Goebel Park.

KY 2 maintains the frontage road concept between MLK Jr. Boulevard and West 4th and 5th streets proposed in Refined Alternative (Concept I-W) but eliminates direct interstate access at West 9th Street. Interstate access will occur at Pike Street, where it exists today. This preserves the residential character of West 9th Street, which is currently a two-lane residential street with parking and eliminates traffic signals. The NB frontage road will also be reconfigured, moving it between 9th Street and Pike Street, which reduces impacts to the Goebel Park Complex.

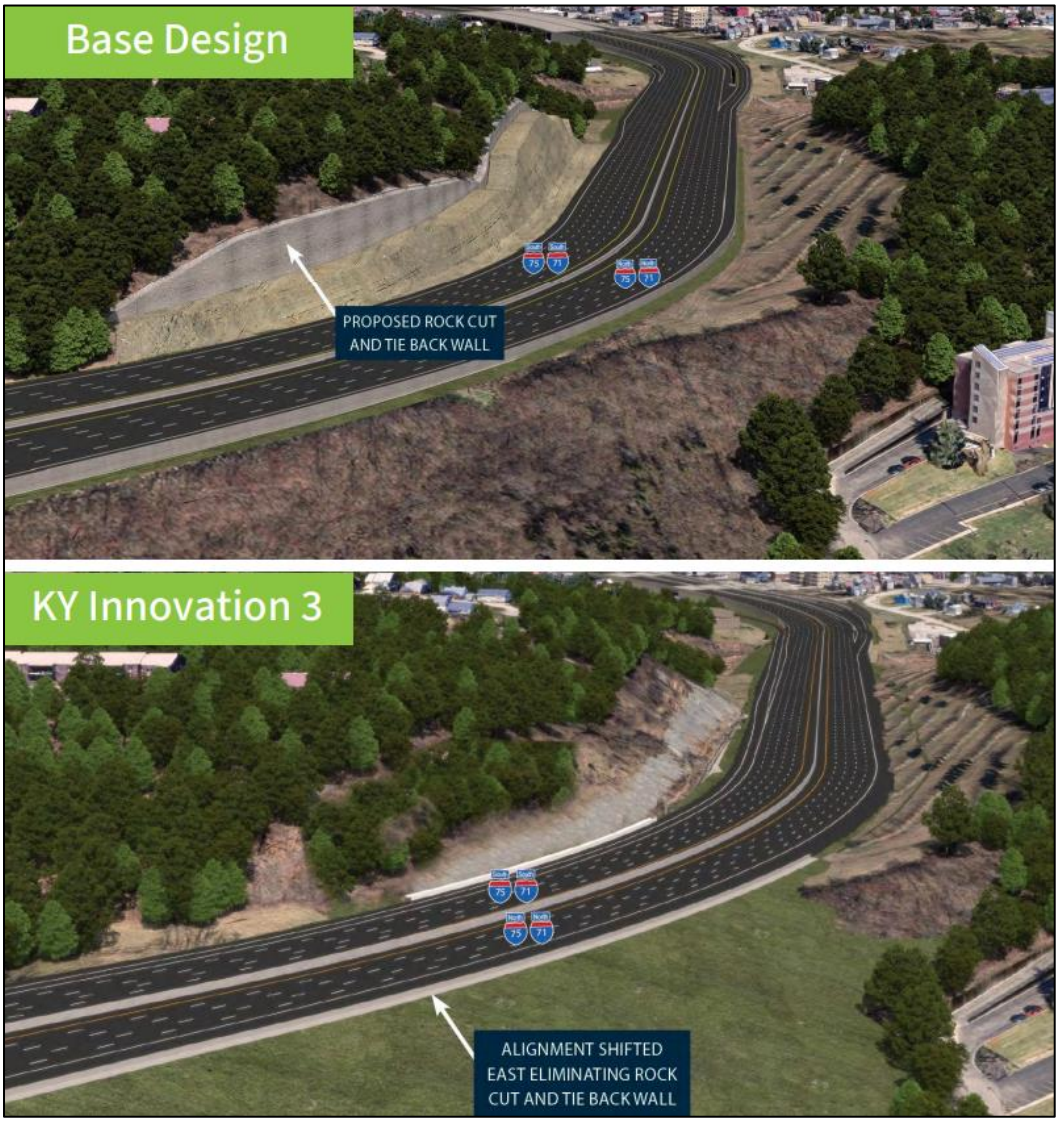
Figure 10: Pike Street Access Optimization



4.7 Kentucky Innovation 3 (KY 3): Hillside Cut Alignment Shift

KY 3 shifts the I-71/I-75 centerline east between Kyles Lane and the MLK Jr. Boulevard exit (**Figure 11**). To shift the road east, six mechanically stabilized earth walls (three cut walls on the west, two fill walls, and one cut wall on the east) totaling approximately 9,000 square feet will be required, as will 23,000 cubic yards of additional fill on the east side of the highway. However, this innovation eliminates approximately 96,000 cubic yards of rock-cut and 62,000 square feet of up to 35-foot-tall tie-back wall. This innovation improves upon Refined Alternative I (Concept I-W) and meets the project's primary goals by reducing long-term maintenance of the tie-back wall.

Figure 11: Cut in the Hill Alignment Shift



4.8 Kentucky Detailed Design Modifications: Roundabouts

Based on detailed design progression, including coordination with the City of Fort Mitchell and the City of Fort Wright, the project will construct sequential roundabouts at either end of the overpass structure at the Kyles Lane and Dixie Highway interchanges (**Figure 12**). This improves constructability and maintenance of traffic during construction, while also reducing pedestrian and vehicle conflict points and allowing for further aesthetic enhancements. At the Dixie Highway interchange, the NB entrance to the C-D road is shifted just north of the Dixie Highway overpass, which creates successive exit ramps for Dixie Highway and Kyles Lane. The overpass NB bridge span is reduced by approximately 30 feet, which amounts to a reduction of approximately 2,850 square feet of bridge. Additionally, the design reduces an estimated 37,500 square feet of pavement area. FHWA has identified roundabouts as a proven safety countermeasure due to their effectiveness in reducing roadway fatalities and serious injury crashes.

Figure 12: Roundabouts at Dixie Hwy and Kyles Lane Interchanges

5. CERTIFIED TRAFFIC

Certified traffic forecasts, including design hours and Annual Average Daily Traffic (AADT), were developed for 2029 and 2049 for the BSB project study limits. The forecasts include Refined Alternative I (Concept I-W) and Build Innovations. The study limits include the I-71 and I-75 interstate between the Buttermilk Pike Interchange in the south and the Hopple Street Interchange in the north and I-71 between the BSB and the US 50/I-471 Interchange. The ramp terminal and adjacent arterial intersections are included in the forecast area. The forecasting parameters, methodology, and certified traffic forecasts are in **Appendix E.**

Overall, the 2049 Refined Alternative I (Concept I-W) forecasts are similar to the Build Innovation forecasts, except at locations impacted by Build Innovation's access modifications. A list of the innovations and the impacts on the traffic forecasts are discussed on the next page.

Ohio Innovations

OH 1: Southbound Roadway Reconfiguration

I-75 Southbound is reconfigured, and the Western Avenue ramp has been removed to southbound I-75. Alternative routes to this ramp include the new proposed 9th Street entrance ramp and the existing Freeman Avenue Interchange. This is a low-volume movement, resulting in minor traffic redistribution.

OH 2: Combination of 2nd and 3rd Street Connections

The SB I-75 2nd Street ramp is removed, and traffic is rerouted through upgraded at-grade 2nd and 3rd Street intersections. The additional delay at these intersections is anticipated to reroute some traffic to the upstream exit ramp at 7th Street.

OH 3: US-50 Roadway Consolidation

The ramp from westbound US-50 to Gest Street has been removed; the primary traffic reroute is through the existing Linn Street exit ramp.

OH 4: Realization of Street Grid Concept

This innovation includes new intersections along Gest Street and a new northbound road between 5th Street and 9th Street. The new connections result in several local routing changes that impact traffic demand on roads between 5th and 9th Street.

Kentucky Innovations

KY 1: Vertical profile optimization

This innovation closes 5th Street between Crescent Avenue and Philadelphia Street. The closure reroutes traffic to 3rd Street and Crescent Avenue.

KY 2: Pike Street Access Optimization

This innovation removes I-71/I-75 SB access to 9th Street at the Bullock Street intersection. The NB frontage road to NB CD road access has also been moved south from 9th Street to Pike Street. These changes result in local traffic shifts caused by access modifications.

KY 3: Hillside Cut Alignment Shift

This innovation has no impact on traffic forecasts.

Design Refinement: Roundabouts at Kyles and Dixie Hwy Interchange

This design refinement has no impact on traffic forecasts.

A screenline comparison of the BSB and CWB Bridge is shown in **Table 2** (Daily), **Table 3** (AM DHV) and **Table 3** (PM DHV). The traffic volumes are very similar between these two alternatives. There is a slight increase in traffic on the CWB due to ramp modifications in Kentucky at 5th Street and in Ohio and the realization of the Street Grid innovation, which results in some traffic shifts between the alternatives.

Table 2: Daily Traffic Forecast Comparison – Ohio River Screenline

Facility			Daily	
Route	Bridge	Direction	2049 Refined Alt I (I-W)	2049 Build Innovations
I-71/I-75	Brent Spence	NB I-71	57,550	58,050
		NB I-75		
		NB I-71/75 CD	38,750	38,000
		SB I-71	60,250	61,350
		SB I-75		
		SB I-71/75 CD	40,500	39,350
US-25/US-42/US-127	Clay Wade Bailey	NB	10,700	11,450
		SB	7,600	7,950
Screenline		NB	*108,400*	*107,500*
		SB	*108,150*	*108,650*
		Total	***215,350***	***216,150***

Table 3: AM Peak Hour Traffic Forecast Comparison – Ohio River Screenline

Facility			AM Peak Hour	
Route	Bridge	Direction	2049 Refined Alt I (I-W)	2049 Build Innovations
I-71/I-75	Brent Spence	NB I-71	5,120	5,180
		NB I-75		
		NB I-71/75 CD	3,840	3,760
		SB I-71	4,230	4,290
		SB I-75		
		SB I-71/75 CD	2,530	2,440
US-25/US-42/US-127	Clay Wade Bailey	NB	1,300	1,520
		SB	350	460
Screenline		NB	*10,260*	*10,460*
		SB	*7,110*	*7,190*
		Total	***17,370***	***17,650***

Table 4: PM Peak Hour Traffic Forecast Comparison – Ohio River Screenline

Facility			PM Peak Hour	
Route	Bridge	Direction	2049 Refined Alt I (I-W)	2049 Build Innovations
I-71/I-75	Brent Spence	NB I-71	4,530	4,530
		NB I-75		
		NB I-71/75 CD	2,910	2,890
		SB I-71	4,710	4,770
		SB I-75		
		SB I-71/75 CD	4,130	4,040
US-25/US-42/US-127	Clay Wade Bailey	NB	910	1,000
		SB	1,080	1,330
Screenline		NB	*8,350*	*8,420*
		SB	*9,920*	*10,140*
		Total	***18,270***	**18,560**

6. TRAFFIC OPERATIONS ANALYSIS

The traffic operational comparison for Refined Alternative I (Concept I-W) and Build Innovations is based on traffic simulation analyses performed using Caliper's TransModeler platform. Travel time and level of service (LOS) metrics are reported for intersections and the freeway mainline segments. The study focuses on AM and PM period operations for the 2049 design year. **Appendix F** describes the complete modeling methodology and results. The corridor-wide operational summary is covered in this section, with detailed segment-by-segment results. The operations analysis described in this section assumes the completion of the I-275 project, which borders the southern project limits. Without the I-275 project, there is anticipated to be an operations concern associated with the existing roadway lanes between Dixie Hwy and I-275; the operations analysis report describes this condition in greater detail. The LOS summaries in the report are based on the peak hours of 7:00-8:00 AM and 4:30-5:30 PM.

6.1 Freeway Operations

The existing I-71/I-75 corridor has recurring travel delays for NB I-71/I-75 in the AM peak, with traffic queues stemming from the BSB and often reaching the I-275 Interchange. The PM peak has recurring traffic delays for SB I-71/I-75 upstream of the BSB, with queues forming on I-75 in Ohio, often reaching the WHV Interchange. Refined Alternative I (Concept I-W) and Build Innovations address these operational deficiencies with the increase in freeway travel lanes and the addition of the C-D system. The I-71/I-75 travel time comparison from the I-275 Interchange to the I-74 Interchange (10.5 miles) is summarized in **Table 5**. Refined Alternative I (Concept I-W) and Build Innovations have nearly free-flow speeds through freeway study limits.

Table 5: Maximum Peak Travel Time (minutes) for I-71/I-75

Facility	Peak Period	2019 Existing	2049 Refined Alternative I (Concept I-W)	2049 Build Innovations
NB I-71/I-75	AM	25	12	12
	PM	12	12	12
SB I-71/I-75	AM	12	12	12
	PM	26	12	12

TransModeler was used to measure the freeway level of service for the I-71, I-75, US 50, and C-D roads. The project study area was divided into HCS-defined segments, including diverges, merges, weaves, and basic segments. These segments and the resultant LOS for each scenario are summarized in **Appendix F**. A high-level summary of the segments that fall within each LOS grade is outlined in **Table 6**. The same project limits are analyzed for all alternatives, but a different number of HCS segments are defined for each alternative.

Table 6: Freeway Segments by LOS Grade

Peak Period	LOS	2049 Refined Alternative I (Concept I-W)	2049 Build Innovations
AM	C or better	62	50
	D	27	31
	E	1	6
	F	1	0
PM	C or better	57	50
	D	25	24
	E	6	11
	F	3	2

Build Innovations and Refined Alternative I (Concept I-W) have only a few segments in the LOS F and LOS E categories. For Build Innovations, two LOS F segments in the PM occur on SB I-75 between 12th Street and Kyles Lane and NB I-75 merge at WHV. The SB I-75 segment is on a steep incline, and speed reductions were observed in both alternatives. The NB I-75 segment has the same design in both alternatives and is outside the area modified by the design innovations.

6.2 Intersection Operations

The operations analysis for the IMS addendum includes 68 intersections. The operational goal is for the intersections to operate at LOS D or better. The results for each intersection are summarized in **Table 7** (Kentucky) and **Table 8** (Ohio). As shown in the tables, Build Innovations achieves the LOS intersection target for all intersections.

Refined Alternative I (Concept I-W) has one intersection with LOS F and two intersections with LOS E, including Philadelphia & 9th Street, Bullock & Pike Street, and Bullock & 12th Street.

Table 7: Kentucky Intersection Level of Service

Intersection	*Refined Alt I (I-W)*	*Build Innovations*	*Refined Alt I (I-W)*	*Build Innovations*
	AM Period		*PM Period*	
NB I-71/I-75 & Dixie Hwy	C	A	A	A
NB I-71/I-75 & Kyles Lane	C	A	B	A
SB I-71/I-75 & Dixie Hwy	C	D	C	A
SB I-71/I-75 & Kyles Lane	B	B	C	B
Dixie Hwy & Kyles Lane	C	B	C	B
Main St & Pike St	C	C	B	B
5th St & Main St	C	C	B	C
4th St & Main St	B	B	B	B
Simon Kenton & 12th St	C	B	C	C
Philadelphia St & 9th St	F	A	A	A
Simon Kenton & Pike	D	B	C	D
Simon Kenton & 9th St	D	C	B	C
Philadelphia & 5th St	D	C	C	C
Philadelphia & 4th St	C	D	C	C
Bullock & 12th St	D	C	E	C
Bullock & Pike St	E	C	B	D
Bullock & 9th St	A	N/A	A	N/A
Crescent & 5th St	A	N/A	A	N/A
Crescent & 4th St	A	A	A	A
Johnson St & 5th St*	-	C	-	B
Johnson St & 4th St*	-	B	-	B
Johnson St & 3rd St*	-	B	-	C
Philadelphia St & 3rd St*	-	C	-	C
Crescent & 3rd St*	-	B	-	A

*Intersections analyzed only for Build Innovations

Table 8: Ohio Intersection Level of Service

Intersection	Refined Alt I (I-W)	Build Innovations	Refined Alt I (I-W)	Build Innovations
	AM Period		PM Period	
Central Ave & 3rd St	D	D	D	D
Central Ave & 4th St	B	A	B	B
Central Ave & 5th St	C	C	B	C
Central Ave & 6th St	A	B	C	D
Central Ave & 7th St	B	B	B	B
Central Ave & 9th St	B	B	C	B
Mound St & 9th St	A	A	A	A
US-42 & 3rd St	C	D	C	D
Gest St & 6th St	A	A	A	A
NB I-75 & 5th Street	B	C	B	B
NB Arterial & 6th Street	N/A	D	N/A	B
NB Arterial & 7th St	N/A	D	N/A	A
NB Arterial & 9th St	N/A	A	N/A	A
Gest St & 8th St	N/A	C	N/A	C
Elm St & 2nd St	B	B	B	C
Race St & 3rd St	B	B	C	C
Elm St & 3rd St	B	B	B	B
Elm St & 4th St	B	B	B	B
Plum St & 3rd St	A	A	B	A
Plum St & 4th St	A	B	A	B
Linn St & 6th St	B	B	B	B
Linn St & 8th St	B	C	B	C
Linn St & Court St	A	A	A	C
Linn St & Ezzard Charles Dr	C	C	C	C
Winchell Ave & Ezzard Charles	B	B	B	B
Freeman Ave & Gest St	C	B	B	B
Western Ave & Gest St	A	B	A	B
Western Ave & Ezzard Charles	A	A	A	A
Winchell Ave & Liberty St	A	A	B	A
Winchell Ave & Findlay St	B	C	B	C
Western Ave & Liberty St	B	B	B	B
Western Ave & Findlay St	B	B	B	B
Dalton Ave & Findlay St	B	B	C	C
Linn St & Bank St	A	A	A	A
Linn St & Central Pkwy	C	B	C	B
Brighton Pl & Central Ave	A	A	A	A
Brighton Pl & Central Pkwy	D	C	C	C
McMillian Ave & Central Pkwy	D	C	C	C
Colerain Ave & Harrison St	A	A	A	A
Patterson St & Harrison St	A	A	A	A
Winchell Ave & Bank St	C	C	C	D
Winchell Ave & Harrison St	A	A	A	A
NB I-75 & WHV	B	B	B	B
Spring Grove Ave & Bank St	A	A	A	B
Spring Grove Ave & Harrison	B	B	B	B

Intersection	Refined Alt I (I-W)	Build Innovations	Refined Alt I (I-W)	Build Innovations
	AM Period		PM Period	
SB I-75 & WHV	B	A	B	B
WHV Ramp & Harrison Street	A	A	A	A

6.3 Turn Lane Storage Lengths

The Build Innovations storage lengths were compared against the 95th percentile queue from the TransModeler analysis and ODOT's storage calculations outlined in reference 401-10. The storage calculations are based on the 2049 AM and PM-certified traffic. Both ODOT's storage length calculation and the TransModeler 95th percentile queues consider the turn queue and the adjacent through lane queue. The turn storage lanes are designed to accommodate through queue blockage.

The turn lane storage calculations are conducted for the AM and PM peak hours, and the higher value is considered the recommended turn lane length. The calculation of the ODOT turn storage lengths is provided in the project files. A summary of the storage lengths for the Phase III and II project limits, recommended through ODOT's calculation and the TransModeler results, is compared to the provided length in **Table 9** and **Table 10**. Turn lanes that are part of a shared-through movement are not reported in these tables. In most cases, the storage lengths are constrained to available right-of-way. Given the limited right-of-way in the downtown area and vicinity intersections, it is rarely practical to meet the ODOT required storage length. At most intersections, it is achievable to stay within the observed 95th percentile queues from the TransModeler simulation.

Table 9: Recommended Turn Lane Storage – Kentucky

Intersection	Approach	Turn Movement	Critical Period	ODOT Storage Lane Calculation (ft)	2049 TransModeler 95th Percentile Queue	Provided Length (ft)
Simon Kenton & 12th	NB	Right	PM	425	105	395
	WB	Right	PM	550	262	575
	EB	Left	AM	500	54	210
Bullock & 12th	WB	Left	PM	450	88	215
	SB	Left	PM	400	225	465
Simon Kenton & Pike	EB	Left	AM	675	183	246
	NB	Right	PM	325	156	423
Bullock & Pike	WB	Left	PM	850	148	248
Main & 5th	SB	Left	PM	575	157	225
Philadelphia & 5th	SB	Left	PM	225	83	173
Main & 4th	NB	Left	AM	725	195	350
	SB	Right	PM	905	224	856
Philadelphia & 4th	NB	Left	PM	550	219	169

Table 10: Recommended Turn Lane Storage – Ohio

Intersection	Approach	Turn Movement	Critical period	ODOT Storage Lane Calculation (ft)	2049 TransModeler 95th Percentile Queue	Provided Length (ft)
CWB & 3rd Street	NB	Left	AM	500	307	140
	SB	Right	AM	500	215	340
	SB	Left	AM	500	214	340
	EB	Right	PM	905	475	1300
	EB	Left	PM	225	91	100
	WB	Right	PM	375	166	450
	WB	Left	PM	450	286	700
Central Ave & 3rd	NB	Left	PM	200	57	100
	EB	Right	AM	250	47	300
	WB	Left	PM	450	256	400
	EB	Left	AM	250	81	450
Central Ave & 5th	SB	Left	PM	200	56	270
Central Ave & 6th	NB	Left	AM	250	54	280
Central Ave & 7th	NB	Right	AM	250	80	75
	EB	Right	AM	675	122	175
Central Ave & 9th	NB	Left	AM	200	55	180
	SB	Right	PM	150	17	240
Elm & 2nd	EB	Left	AM	400	76	400
Race & 3rd	SB	Right	PM	600	328	235
	WB	Left	PM	700	212	410
Elm & 3rd	NB	Left	PM	325	105	150
	WB	Right	PM	875	126	130
Elm & 4th	NB	Left	AM	300	92	160
	WB	Right	PM	100	1	340
Plum & 4th	WB	Left	PM	150	0	50
Linn & Dalton	NB	Left	PM	200	54	125
	SB	Right	PM	225	79	600
	EB	Left	PM	100	17	500
	EB	Right	PM	500	0	500
	WB	Left	AM	200	63	180
Linn & 8th	NB	Left	AM	225	89	300
	NB	Right	PM	150	7	150
	SB	Left	PM	225	149	210
	EB	Left	AM	375	199	270
	EB	Right	AM	225	17	120
	WB	Left	PM	100	55	470
Freeman & Gest	NB	Left	AM	300	116	300
	NB	Right	AM	300	131	180
	SB	Left	AM	325	105	170
	EB	Left	PM	200	70	60
	EB	Right	PM	225	70	160

Intersection	Approach	Turn Movement	Critical period	ODOT Storage Lane Calculation (ft)	2049 TransModeler 95th Percentile Queue	Provided Length (ft)
	WB	Left	AM	200	73	240
	WB	Right	PM	200	74	110
Winchell & Ezzard	EB	Left	AM	200	57	200
	WB	Right	PM	250	17	150
Western & Ezzard	WB	Left	AM	225	61	100
	SB	Left	PM	225	33	180
NB Arterial & 5th Street	NB	Right	AM	550	233	300
NB Arterial & 6th Street	WB	Right	PM	575	99	360
NB Arterial & 7th Street	NB	Right	AM	850	99	200
NB Arterial & 9th Street	WB	Right	PM	550	32	150
Gest Street & 8th Street	NB	Left	PM	200	169	200
	NB	Right	AM	200	169	200
	EB	Right	PM	325	N/A	592
	WB	Left	PM	100	N/A	80
Linn & Ezzard Charles	NB	Left	PM	225	76	200
	NB	Right	PM	225	68	50
	SB	Left	PM	375	130	100
	SB	Right	PM	375	138	100
	EB	Left	AM	200	74	180
	WB	Left	PM	200	47	175

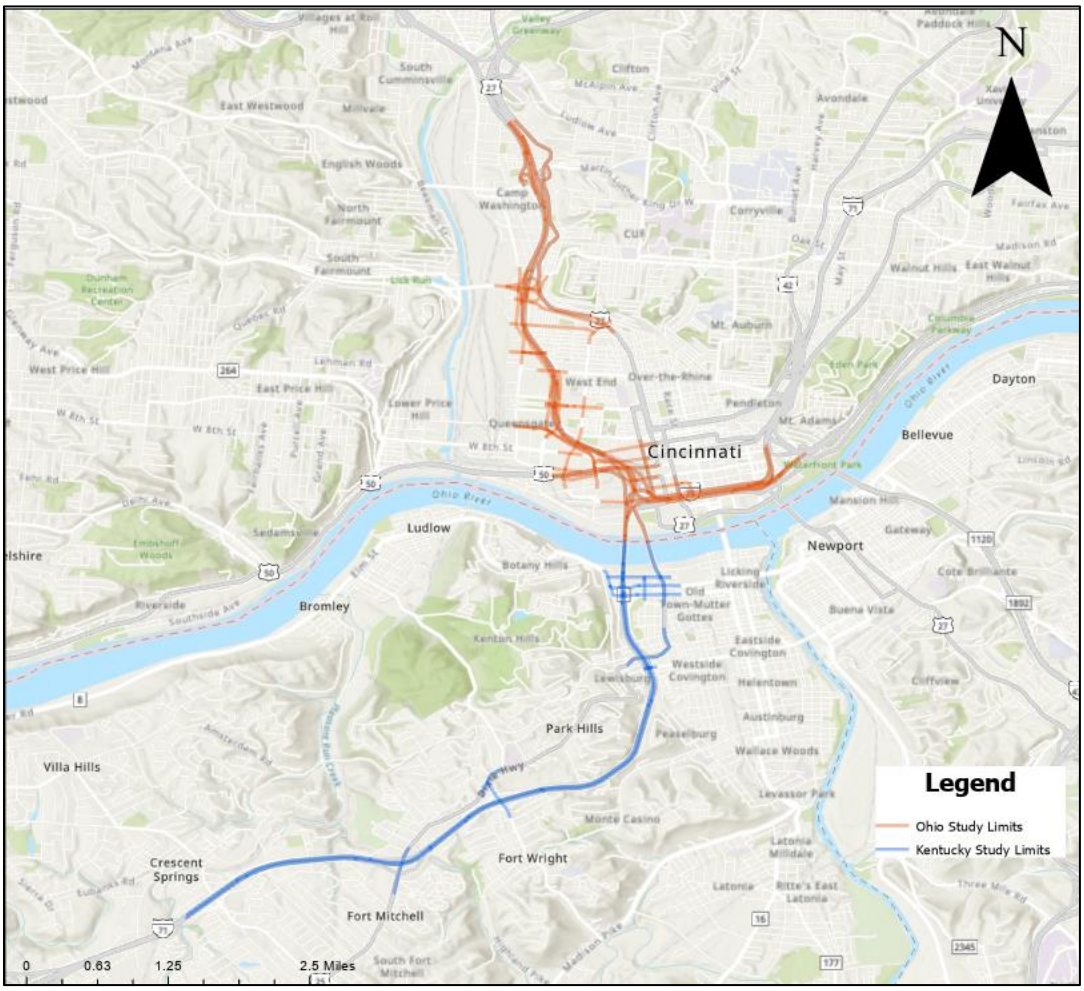
7. SAFETY ANALYSIS

Safety analysis of the BSB corridor is documented in **Appendix G**: *IMS Addendum Safety Analysis.* The purpose of the safety analysis is to highlight existing crash trends; identify safety priority locations in Kentucky and Ohio; provide a comparison of predictive safety for Refined Alternative I (Concept I-W) and Build Innovations; and identify crash countermeasures that should be considered as the BSB project moves into detailed design. A summary of the findings is provided in this section.

7.1 Existing Crash Trends

Crash data for the five years from 2019 to 2023 was collected from Ohio and Kentucky within the study area to identify crash patterns and trends. The limits of the existing crash trend analysis are shown in **Figure 13**.

Figure 13: Historical Crash Analysis Study Limits



ODOT and KYTC identify safety-priority roadway segments using existing crash data. Most of the I-71 and I-75 freeway segments are identified as priority locations for the project corridor. This means there is an elevated frequency of crashes compared to similar facilities. The project team reviewed five years of crash data and found a significant pattern of rear-end and sideswipe crashes, typical in congested urban freeway systems with high ramp density. A summary of the project limit crashes by facility types are summarized in **Table 11** (Kentucky) and **Table 12** (Ohio).

Table 11: Total Crashes by Roadway Part – Kentucky 2019-2023

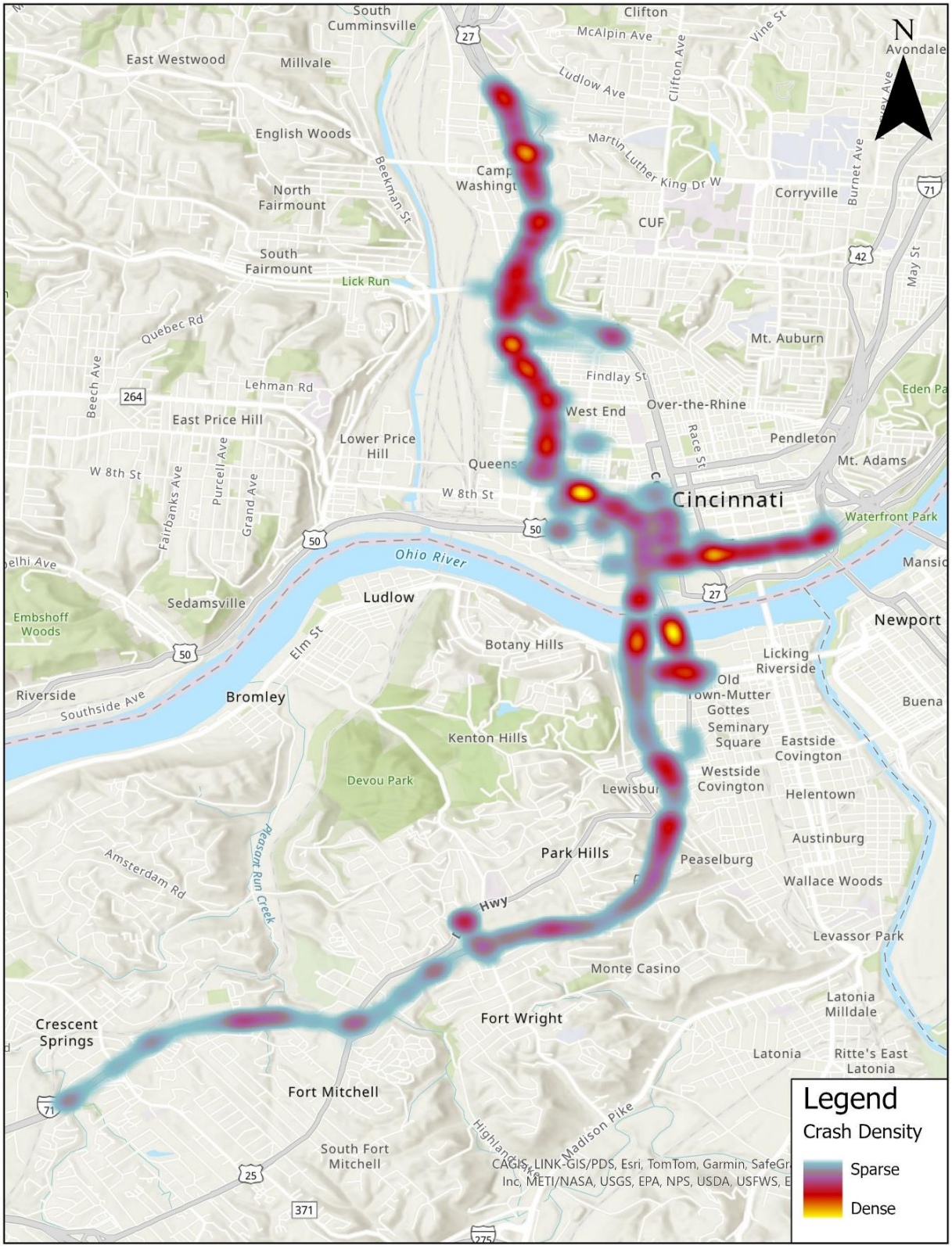
Crash Location	2019	2020	2021	2022	2023	Total
Freeway	827	592	486	545	463	2913
Arterial	93	241	229	81	74	718
Intersection	142	150	193	137	108	730
Ramp	65	49	54	33	38	239
Total	1127	1032	962	796	683	4600

Table 12: Total Crashes by Roadway Part – Ohio 2019-2023

Crash Location	2019	2020	2021	2022	2023	Total
Freeway	755	614	675	559	698	3301
Arterial	255	247	274	235	207	1218
Intersection	179	159	125	138	132	733
Ramp	56	57	59	64	77	313
Total	1245	1077	1133	996	1114	5565

A crash density map showing the locations in the corridor with the highest crash frequencies is shown in **Figure 14.** This map includes all crashes within the corridor and shows a higher density of crashes on the Brent Spence Bridge, Clay Wade Bailey Bridge, and along the freeway system in Ohio. The highest density of crashes in Kentucky, besides the Ohio River bridges, is I-71/75 between Kyles Lane and MLK Drive. The I-75 crash density in Ohio is consistently high through the project corridor. ODOT's AASHTOware safety software identifies the BSB project segment of I-75 as the 7th highest potential for safety improvement (PSI) segment in Ohio, with the I-71 segment leading to the BSB as the 8th highest.

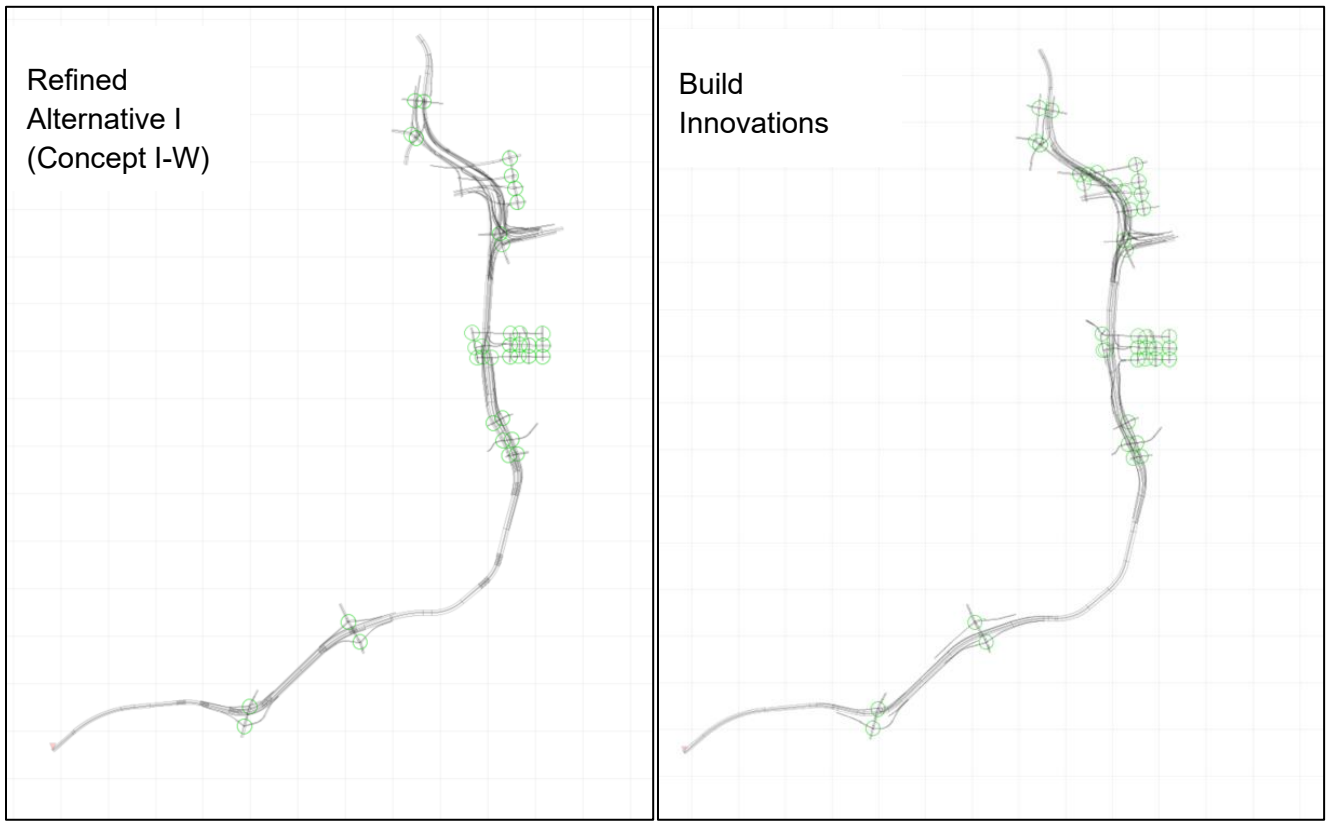
Figure 14: Existing Crash Density: 2019-2023



7.2 Alternative Safety Comparison

The I-71/I-75 Phase II and III limits are evaluated with IHSDM predictive safety analysis to quantify anticipated changes to crash frequencies between the two alternatives. The analysis captures the freeway mainline crashes between Buttermilk Pike on the southern limits and Ezzard Charles on the northern limits. The project innovations do not change the geometry north of Ezzard Charles between the two alternatives, and the traffic volume differences are nominal. The freeway ramps, ramp terminal intersections, and arterial intersections within these limits are also included. **Figure 15** shows the IHSDM model extents for the I-71/I-75 corridor.

Figure 15: BSB Phase II and III IHSDM Model Limits



A summary of the crash totals by severity for the freeway mainline, C-D Roads & ramps, arterials, and intersections are summarized in **Table 13.** The crash totals listed in the table are predicted crashes using the Highway Safety Manual procedures with default calibration parameters provided by FHWA. The crash costs summaries are based on ODOT 4-code economic unit costs published in May 2024. These costs convert the predicted crash frequencies by severity to total safety costs. The cost values are:

- K/A: $502,809
- B: $72,068
- C: $48,848
- PD: $11,008

Table 13: 20-Year Predicted Crashes for BSB Project Phase II and III Limits

Alternative	Facility	Predicted Crashes: 2029-2049						20-Year
		K	A	B	C	PD	Total	Crash Cost ($Million)
Refined Alternative I (Concept I-W)	Freeway Mainline	26.5	73	500	1375	4832	6807	$206.6
	C-D Roads & Ramps	15.8	48	272	645	1470	2450	$99.3
	Arterials	2.3	13	64	139	486	705	$24.6
	Intersections	1.4	31	163	508	1766	2470	$72.2
	Total	46.0	165	1000	2668	8554	12432	$402.6
Build Innovations	Freeway Mainline	25.5	71	484	1418	4635	6633	$203.6
	C-D Roads & Ramps	18.9	57	323	777	1696	2872	$118.2
	Arterials	2.5	15	71	145	496	730	$26.7
	Intersections	1.3	33	172	447	2101	2756	$74.9
	Total	48.5	177	1051	2787	8929	12992	$423.4

Overall, the crash totals for the two alternatives are very similar. Build Innovations reduces the crash costs for the freeway mainline by incorporating wider cross sections at the Companion Bridge, and improving the southern terminus of the project near Dixie Hwy. The arterial and intersection crashes are higher in the Build Innovations due to the increase in arterial roadways. Many traffic movements in Ohio, which are served with direct ramps in Refined Alternative I (Concept I-W), are provided through intersections with Build Innovations. Build Innovation design refinements achieve other project objectives, such as reducing right-of-way impacts and enhancing pedestrian accommodations, but additional intersections do lead to increased vehicle conflict, which is one trade-off with the design changes. The increase in arterial crashes is mitigated by designing intersections in accordance with FHWA's proven safety countermeasures for intersections[2]. These guidelines highlight the value of roundabouts, dedicated left and right turn lanes, yellow change intervals, leading pedestrian intervals, crosswalk visibility enhancements, and medians with pedestrian refuge islands. These strategies are implemented at the new intersections in Build Innovations.

The other difference in the predictive results indicates increased crash costs for the Build Innovations C-D roads and ramps. Design enhancements convert some 1-lane C-D roads to 2-lane C-D roads, which have safety performance functions with a higher crash frequency. Additionally, C-D road gore points were updated, leading to more C-D road length in Build Innovations and higher C-D road crash rates from IHSDM than freeway mainlines.

[2] https://highways.dot.gov/safety/proven-safety-countermeasures

7.3 Safety Comparison of Innovations

A predictive safety comparison of select facilities that are associated with each innovation is discussed in this section.

7.3.1 Ohio Innovation 1 – SB I-75 Roadway Reconfiguration

The reconfiguration of the SB I-75 through lanes and the CD SB exits resulted in the removal of the curve immediately north of the proposed bridge entry point and an increase in the radius of the upstream curve (near US 50 to W 3rd Street). The changes to the CD SB lanes related to the swap with SB I-75 do not result in anticipated safety impacts compared to Refined Alternative I (Concept I-W) based on similar geometry and traffic patterns across both alternatives. The anticipated impact is verified through an IHSDM predictive analysis. The IHSDM predictive analysis for Ohio Innovation 1 evaluates the I-75 mainline and SB I-75 C-D road between the Ohio River and Ezzard Charles. The predictive crash analysis for these segments is summarized in **Table 14**. The results show that Build Innovations has slightly improved corridor safety related to Innovation 1.

Table 14: 20-year Predicted Crashes for Ohio Innovation 1

Alternative	Facility	Predicted Crashes: 2029-2049						Crash Cost ($ Million)
		K	A	B	C	PD	Total	
Refined Alternative I (Concept I-W)	I-75 Mainline	2.0	6	37	77	276	397	13.2
	I-75 SB C-D	0.5	1	8	22	63	95	$3.3
	Total	3.5	10	64	148	522	747	$16.5
Build Innovations	I-75 Mainline	1.8	5	33	63	226	329	$11.2
	I-75 SB C-D	0.5	2	9	25	78	114	$3.8
	Total	2	6	41	88	305	443	$15.0

7.3.2 Ohio Innovation 2 – Combination of 2nd and 3rd Street Connections

For OH 2, the 2nd and 3rd Street ramps are consolidated with the ramp traffic directed to the intersection at Clay Wade Bailey intersections. While the Build Innovations design increases the volume of traffic, lanes, and potential conflict points through the 2nd and 3rd Street intersections, these are mitigated with signal coordination and phasing. At Clay Wade Bailey and W 3rd Street, the increase in traffic is the SB through movement, which will be mitigated with protected left turn-only signal phasing for the corresponding NB left movement. Southbound right turn traffic movements at the intersection of Clay Wade Bailey and W 3rd Street do not increase for Build Innovations compared to Refined Alternative I (Concept I-W). Northbound right-turn volumes have increased by approximately 20%. The redesigned pedestrian island on the north side of the intersection will enable the use of Leading Pedestrian Interval (LPI) timing in the signal design, if necessary. This will help separate the timing of pedestrian and vehicular movements. The Clay Wade Bailey and 2nd Street intersection will be signalized with full pedestrian signals, phasing, and accommodations to overcome the increase in anticipated left-turning movements with the Build Innovations alternative.

A predictive crash analysis is completed to understand the anticipated impact in crash frequency with the design innovation. The analysis includes the I-75 SB exit ramps to 2nd and 3rd Street and the CWB intersections at 3rd and 2nd Street. As summarized in **Table 15**, the analysis indicates an increase in crashes for Build Innovations, with more crashes on the exit to 3rd Street due to volume increases, plus an increase in crashes at the 2nd and 3rd Street intersections. These crashes will be minimized by using FHWA's proven safety countermeasures at the signalized intersections.

Table 15: 20-year Predicted Crashes for Ohio Innovation 2

Alternative	Facility	Predicted Crashes: 2029-2049						Crash Cost ($ Million)
		K	A	B	C	PD	Total	
Refined Alternative I (Concept I-W)	SB I-75 Exit to 2nd Street	0.4	1	7	20	62	91	$3.1
	SB I-75 Exit to 3rd Street	0.0	0	1	1	2	3	$0.2
	CWB & 2nd Street Intersection	0.0	0	1	1	5	7	$0.3
	CWB & 3rd Street Intersection	0.0	1	3	6	47	57	$1.3
	Total	0.5	2	11	28	116	158	$4.8
Build Innovations	SB I-75 Exit to 3rd Street	1.0	3	15	35	77	132	$5.6
	CWB & 2nd Street Intersection	0.0	0	1	2	14	17	$0.5
	CWB & 3rd Street Intersection	0.2	4	22	54	185	265	$8.5
	Total	1.2	8	39	91	276	414	$14.7

7.3.3 Ohio Innovation 3 – US-50 Roadway Consolidation

The consolidation of US-50 offers slightly increased radii compared to Refined Alternative I (Concept I-W). Refined Alternative I (Concept I-W) includes a lane drop where US-50 EB merges with the CD road at W 2nd Street. This requires drivers to assess the merge over their right shoulder towards the outside of the curve, expanding the driver's blind spot. This lane drop is removed in Build Innovations. Build Innovations adds a different lane drop from the CD road SB into US-50 EB as it merges into I-71 NB; however, this merge is outside the curve, where the driver's vision is not compromised. The IHSDM predictive results indicate a slight safety improvement with Build Innovations, as summarized in **Table 16**.

Table 16: 20-year Predicted Crashes for US-50

Alternative	Predicted Crashes: 2029-2049						Crash Cost ($ Million)
	K	A	B	C	PD	Total	
Refined Alternative I (Concept I-W)	1.5	5	26	65	151	248	$9.8
Build Innovations	1.2	4	20	54	132	211	$8.0

7.3.4 Ohio Innovation 4 – The Realization of the Street Grid

Ohio Innovation 4 includes new at-grade intersections utilizing one-way pairs for the NB CD exit ramp. The new intersections introduce additional conflict points within the project limits. Using one-way pairs limits left-turn conflicts, eliminating the most serious conflict points while offering opportunities to accommodate pedestrians and cyclists through the interchange area safely.

In addition to the NB arterial, an at-grade intersection was created at the Gest Street and 8th Street intersection. This new intersection offers improved accommodations for pedestrians and cyclists by introducing an at-grade intersection instead of fly-over ramps. To mitigate the increased conflicts introduced with the improved access, protected left turn signal phasing, pedestrian refuge islands, leading pedestrian intervals, and dedicated right turn lanes on EB and SB approaches will minimize crashes that may occur due to additional conflict points.

An IHSDM model is developed to analyze ramps and intersections associated with the realization of the street grid innovation to quantify the differences in predicted crashes. This model includes service ramps and arterial intersections within and adjacent to the design limits. The IHSDM results are summarized in **Table 17.** The modeling shows an increase in predicted crashes due to the introduction of new at-grade intersections.

Table 17: 20-year Predicted Crashes for Ohio Innovation 4

Alternative	Facility	Predicted Crashes: 2029-2049						Crash Cost ($ Million)
		K	A	B	C	PD	Total	
Refined Alternative I (Concept I-W)	NB Exit to 5th Street	0.1	0	1	3	8	12	$0.4
	NB Entrance from 6th Street	0.1	0	2	4	9	16	$0.7
	SB Exit to 7th Street	0.9	3	15	43	109	171	$6.2
	US-50 EB to 5th Street	0.1	1	3	5	21	29	$1.0
	Central Avenue & 5th Street Int.	0.0	1	4	10	54	70	$1.8
	Central Avenue & 6th Street Int.	0.0	1	4	10	57	73	$1.9
	Central Avenue & 7th Street Int.	0.0	1	4	10	56	71	$1.8
	Central Avenue & 9th Street Int.	0.0	1	4	9	52	66	$1.7
	NB I-75 Intersection at 5th Street	0.0	0	1	2	10	13	$0.4
	Total	1.3	7	39	96	376	519	$16.1
Build Innovations	NB Exit to 5th Street	0.1	0	3	7	23	33	$1.1
	NB Entrance from 6th Street	0.1	1	6	12	42	60	$2.0
	SB Exit to 7th Street	0.7	2	12	33	65	113	$4.6
	US-50 EB to 5th Street	0.1	1	2	4	16	23	$0.9
	Central Avenue & 5th Street Int.	0.1	1	6	13	68	88	$2.4
	Central Avenue & 6th Street Int.	0.0	1	5	12	68	87	$2.3
	Central Avenue & 7th Street Int.	0.1	1	6	14	85	106	$2.6
	Central Avenue & 9th Street Int.	0.0	1	4	9	36	51	$1.6
	NB I-75 Intersection at 5th Street	0.0	1	4	8	31	43	$1.4
	NB Arterial & 6th Street Int.	0.0	1	5	12	68	87	$2.3
	NB Arterial & 7th Street Int.	0.1	1	6	14	85	106	$2.6
	NB Arterial & 9th Street Int.	0.0	1	4	10	38	53	$1.6
	Gest & 8th Street Int	0.0	1	3	8	26	38	$1.3
	Gest & 7th Street Int.	0.0	0	1	4	38	44	$0.9
	Total	1.4	13	67	160	690	931	$27.4

7.3.5 Kentucky Innovation 1: Vertical Profile Optimization

The Build Innovations improve the corridor's visual impact, geometry, and transitions. The overall height of the interchange was reduced by approximately 20 feet. The total bridge area and structure heights were reduced significantly, leading to reduced costs. The transition between the C-D and frontage roads was improved and aligned more with each roadway's function. The simplified geometry provides consistent vertical grade into the companion bridge and moves the successive curves away from the bridge. While IHSDM cannot directly capture the safety benefit of vertical profile optimization, there are considerable improvements to constructability and costs that provide safety benefits by improving horizontal geometry and transitions.

For Innovation 1, the right-hand exit from the C-D Road converts to a left-hand exit. Access to 5th Street is only provided eastbound after exiting I-71/75, with 5th Street closed between Crescent Avenue and C-D road. Traffic

from the southbound C-D Road has the right of way into an added lane, and the northbound C-D Road will yield. While it is generally not recommended to have left-hand exits for high-speed ramp terminals, they are acceptable for C-D roads due to the lower-speed characteristics of the collected traffic destined for local streets. The design speed on I-71/75 is 55 mph, while the C-D system is designed for 45 mph. Separating local traffic from the interstate improves the traffic flow and increases capacity by separating the high-speed traffic from the lower-speed local traffic. The predictive analysis completed for network elements associated with this innovation suggests a slight safety benefit for Build Innovations, as summarized in **Table 18**.

Table 18: 20-year Predicted Crashes for Kentucky Innovation 1

Alternative	Facility	Predicted Crashes: 2029-2049						Crash Cost ($ Million)
		K	A	B	C	PD	Total	
Refined Alternative I (Concept I-W)	SB CD Road	0.6	2	11	24	85	123	$4.0
	5th Street Exit	0.1	0	1	1	3	6	$0.4
	4th and Philadelphia Int.	0.0	1	4	10	54	69	$1.8
	5th & Philadelphia Int.	0.0	1	3	8	44	56	$1.5
	3rd & Philadelphia Int.	0.0	1	4	9	25	39	$1.4
	3rd & Crescent Int.	0.0	1	4	10	39	54	$1.6
	4th & Crescent Int.	0.0	1	4	9	25	38	$1.3
	5th & Crescent Int.	0.0	0	1	1	8	11	$0.4
	Total	0.9	6	32	72	283	394	$12.3
Build Innovations	SB CD Road	0.5	1	10	21	68	101	$3.4
	5th Street Exit	0.1	0	1	2	4	8	$0.5
	4th and Philadelphia Int.	0.0	1	4	10	55	69	$1.8
	5th & Philadelphia Int.	0.0	1	3	8	41	53	$1.4
	3rd & Philadelphia Int.	0.0	1	4	9	27	41	$1.4
	3rd & Crescent Int.	0.0	0	1	4	28	34	$0.7
	4th & Crescent Int.	0.0	0	0	1	2	3	$0.2
	Total	0.8	4	25	54	224	308	$9.5

7.3.6 Kentucky Innovation 2: Pike Street Access Optimization

In Build Innovations, the at-grade intersection and access at Simon Kenton Way and Pike St from the Refined Alternative I (Concept I-W) are still proposed. The difference is that there is no longer an at-grade intersection for northbound Simon Kenton Way and 9th Street. This will maintain the existing condition at 9th Street and avoid adding conflict points, resulting in a safety benefit. The predictive analysis for this innovation is summarized in **Table 19**.

Table 19: 20-year Predicted Crashes for Kentucky Innovation 2

Alternative	Facility	Predicted Crashes: 2029-2049						Crash Cost ($ Million)
		K	A	B	C	PD	Total	
Refined Alternative I (Concept I-W)	Simon Kenton	0.1	0.6	3.9	7.7	24.3	37	$1.3
	Pike Street & Simon Kenton	0.1	1.3	6.7	15.6	81.1	105	$2.8
	9th Street & Simon Kenton	0.0	0.5	2.0	5.6	27.5	36	$1.0
	Total	0.2	2.4	13	28.9	132.9	177	$5.1
Build Innovations	Simon Kenton	0.1	0.4	2.1	4.0	13.6	20	$0.74
	Pike Street & Simon Kenton	0.0	0.8	4.4	10.2	52.3	67.7	$1.8
	9th Street & Simon Kenton	0.0	0.4	2.0	4.7	23.4	30.4	$0.8
	Total	0.1	1.6	8.5	18.8	89.2	118.2	$3.4

7.3.7 Kentucky Innovation 3: Cut In the Hill Alignment Shift

This innovation includes a shift in alignment that increases the centerline radius near station 496 to 1850'. Increasing radii on a curved roadway segment can improve safety by reducing all crash types, especially lane departures. The predictive safety analysis summarized in **Table 20** indicates a minor safety benefit for this innovation.

Table 20: 20-year Predicted Crashes for Kentucky Innovation 3

Alternative	Facility	Predicted Crashes: 2029-2049						Crash Cost ($ Million)
		K	A	B	C	PD	Total	
Refined Alternative I (Concept I-W)	I-71/I-75 Mainline Between Kyles and 12th Street	7.6	21	142	355	1278	1804	$56.0
Build Innovations	I-71/I-75 Mainline Between Kyles and 12th Street	7.2	20	135	365	1243	1769	$54.8

7.3.8 Kentucky Detailed Design Modification: Roundabouts

FHWA has identified roundabouts as a proven safety countermeasure due to their effectiveness in reducing roadway fatalities and serious injury crashes. The channelized, curved approaches require vehicles to reduce speed as they enter the roundabout, resulting in less severe collisions. Also, reduced speed allows drivers more reaction time to other vehicles or pedestrians. Converting a traditional signalized intersection to a roundabout minimizes conflict points from 32 to 8, lowering the chances of a severe crash. The crossing conflict points, which typically result in the most severe crashes, are eliminated with a roundabout. Left-hand, right-angle, and head-on crashes are generally eliminated, leaving rear-end or sideswipe crashes as the typical crash type. This lower speed and reduced conflict point environment is more accommodating to bicyclists and pedestrians. A bicyclist or pedestrian can cross one direction of travel at a time compared to crossing two directions of travel at a traditional intersection. Typically, a roundabout effectively reduces delay and queuing, resulting in improved traffic flow compared to a traditional intersection. Roundabouts provide an environmental benefit by reducing stop-and-go traffic, leading to lower vehicle idling time and fewer emissions. Roundabouts effectively transition traffic from high-speed to low-speed environments such as interchange ramp terminals. The BSB Corridor project has proposed a roundabout at Crescent Avenue and 3rd Street, and Kyles Lane and Dixie Hwy interchange ramp terminals. Crash modification factors were provided from ODOT for conversion of signalized intersections into single- or multi-lane roundabouts. The provided crash modification factor for type K, A, B and C crashes is .29 and the crash modification factor provided for PD crashes is .74. For predictive crash analysis, these CMFs were applied as a user input directly in IHSDM. The interchange ramp terminals are modeled as signalized intersections, and the factor is applied to convert the signalized intersections to roundabouts. The Crescent and 3rd Street intersection is modeled a signalized intersection with the provided CMF and is evaluated as part of Kentucky Innovation 1 The Dixie Hwy and Kyles Lane interchanges predictive safety results are summarized by intersection in **Table 21.** The predictive safety results show that introducing roundabouts at the Dixie Hwy and Kyles Lane ramp terminals and the Crescent and 3rd street intersection would benefit Build Innovations.

Table 21: 20-year Predicted Crashes for Kentucky Detailed Design Modification

Alternative	Facility	Predicted Crashes: 2029-2049						Crash Cost ($ Million)
		K	A	B	C	PD	Total	
Refined Alternative I (Concept I-W)	NB I-71/I-75 & Dixie Hwy Int.	0.1	3	15	68	122	208	$7.1
	SB I-71/I-75 & Dixie Hwy Int.	0.1	2	14	63	124	203	$6.6
	NB I-71/I-75 & Kyles Lane Int	0.1	3	15	68	128	214	$7.1
	SB I-71/I-75 & Kyles Lane Int	0.1	2	12	54	103	171	$5.7
	Total	0.4	9	56	253	478	796	$26.5
Build Innovations	NB I-71/I-75 & Dixie Hwy Int.	0.0	0.8	5	21	97	123	$2.8
	SB I-71/I-75 & Dixie Hwy Int.	0.0	0.7	4	18	93	116	$2.6
	NB I-71/I-75 & Kyles Lane Int	0.0	0.8	5	22	104	131	$3.0
	SB I-71/I-75 & Kyles Lane Int	0.0	0.7	4	20	89	114	$2.6
	Total	0.1	3.0	18	81	382	484	$11.0

8. COST ESTIMATES

A Cost, Schedule, and Risk Assessment workshop held by FHWA and the project team in October 2022 confirmed that the total project cost estimate is $3.6 billion, which includes all costs required to deliver the project, including but not limited to planning, design, right-of-way acquisition, construction, construction management services, and agency labor.

Updated cost estimates for Build Innovations are still being developed. The final IMS submittal will include the most recent cost estimate.

9. ENVIRONMENTAL OVERVIEW

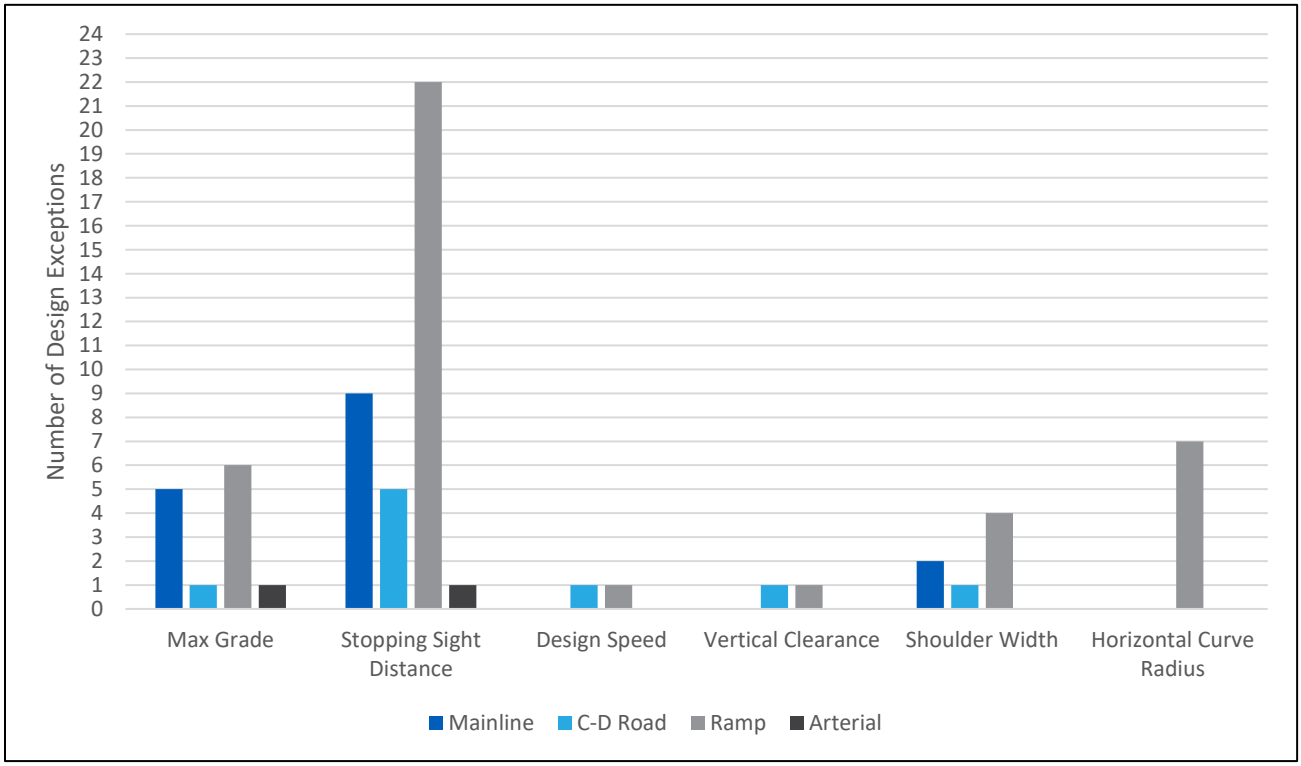
In accordance with the National Environmental Policy Act (NEPA), an Environmental Assessment (EA) was prepared for the Brent Spence Bridge (BSB) Corridor Project in the Commonwealth of Kentucky and the State of Ohio in March 2012. A Finding of No Significant Impact (FONSI) was approved by the Federal Highway Administration (FHWA) on August 9, 2012. Two environmental re-evaluations were approved in 2015 and 2018. A supplemental EA/FONSI for Refined Alternative I (Concept I-W) was approved by FHWA on May 8, 2024.

The project team submitted the environmental re-evaluation for the Build Innovations alternative in April 2025. FHWA approved the reevaluation on August 13, 2025. The re-evaluation reflects not only the Build Innovations alternative but also changes based on advanced design development, conditions, and updated requirements.

10. DESIGN EXCEPTIONS

Build Innovations has 10 design exceptions in Kentucky and 58 in Ohio. This represents a slight increase in overall design exceptions compared to Refined Alternative I (Concept I-W), which had 19 design exceptions in Kentucky and 35 in Ohio. Kentucky's design exceptions have been reduced by nine, while Ohio's has an increase of 23 compared to the previously preferred alternative. The changes in the design exceptions are a direct result of the innovations and design development. The majority of design exceptions are not on the mainline but rather are related to ramps and the C-D roads. The proposed design is close to meeting the design standards in most cases, and the design exception differences are not worse than previous design exceptions for the critical elements FHWA is most concerned with for the freeway system. **Figure 16** summarizes the design exceptions by type and category. The design exceptions for Build Innovations are listed in **Table 22** and **Table 23.**

Figure 16: Build Innovations Design Exception Summary



The design-build team will consider design enhancements as the design progresses and will not provide a design solution worse than the one currently proposed. Where resolving the design exception is impossible, the project sponsors will retain decision-making authority and approvals, with an adequate justification in a design exception report. Mitigation strategies will be considered for the remaining design exceptions to improve safety by providing drivers with ample warning, improving vehicle control, and enhancing drainage systems. These strategies may include, but are not limited to, high friction pavement treatments and advisory signing where applicable.

Table 22: Build Innovations Design Exceptions – Kentucky

Route	Station	Item	Min. Design Criteria	Design Criteria Reference	Provided	Design Exception/ Deviation
Kyles Ramp F	NA	Maximum Grade	6.0%	HD-904.4 KYTC HDGM	7.0%	Deviation from approved design criteria. Meets AASHTO
Kyles Ramp D	NA	Maximum Grade	6.0%	HD-904.4 KYTC HDGM	7.1%	Deviation from approved design criteria. Meets AASHTO
Orchard Road	NA	Maximum Grade	8.0%	Exhibit 700-04 KYTC HDGM	10.20%	Deviation from approved design criteria. Meets KYTC 700-04
Orchard Road	NA	Stopping Sight Distance	155 FT	Table 3-1 AASHTO Green Book, 7th Ed.	<155 FT	Exception
SB C-D Road	Sta 457+21 to 482+75	Design Speed	55 mph	Table 1-2, Appendix E Technical Requirements	45 mph	Deviation
NB C-D Road	Curve PI 329+94.35	Horizontal Stopping Sight Distance	510 FT	Table 3-1 AASHTO Green Book, 7th Ed. (55mph adjusted for downgrade)	427 FT	Exception or deviation to be addressed in the next phase of the design
NB C-D Road	Sta 378+22 to Sta 382+51	Vertical Clearance	16.5 FT	HD-903.2 KYTC HDGM	15 FT	Exception
NB C-D 4th St Entrance Ramp	Sta 705+73 to Sta 709+87	Vertical Clearance	16.5 FT	HD-903.2 KYTC HDGM	15 FT	Exception
NB C-D 4th St Entrance Ramp	Curve PI 705+29.34	Horizontal Stopping Sight Distance	190 FT	Table 3-1 AASHTO Green Book, 7th Ed. (30mph adjusted for upgrade)	180 FT	Exception or deviation to be addressed in the next phase of the design
SB C-D 5th St Exit Ramp	Curve PI 11+07.79	Design Speed	30mph	Table 10-1 AASHTO Green Book, 7th Ed.	20 mph	Exception

Table 23: Build Innovations Design Exceptions – Ohio

Route	Station	Design Met (Required)	Horizontal Dc (Max)	Horizontal SSD (Min)	Vertical SSD (Min)	Vertical K (Min)	Maximum Grade (Required)	Other	Design Speed Existing	Design Criteria
I-71 NB	94+50.22	51 mph (55)	6°30'13" (5°30'00")						45 mph	Horizontal Curve Radius = 5°30'00" - ODOT 202.3
I-71 NB	94+50.22	42 mph (55)		335' (495')						HSSD = 495' - ODOT 201.2
I-71 NB	91+34.23	50 mph (55)			425' (495')	84.4 (114)				K >= 114 - ODOT 203-3
I-71 NB	101+50.00						6.48% (5.00%)			Max Grade = 5% - ODOT 203.2
I-71 NB	106+03 to 108+54							Min 3.5' Paved Shoulder Width		Shoulder Width >= 10' or >=8' (for accel/decel lane) - ODOT 301.2. & 303.1
I-75 NB	20+39.79	54 MPH (55)		491' (495')						HSSD = 495' - ODOT 201.2
I-75 NB	36+50.36	51 MPH (55)		443' (495')						HSSD = 495' - ODOT 201.2
I-75 NB	47+77.24	53 MPH (55)		474' (495')						HSSD = 495' - ODOT 201.2
I-75 SB	45+10.23	51 MPH (55)		443' (495')						HSSD = 495' - ODOT 201.2
I-71 SB	94+87.99	45 mph (55)		365' (495')					35 mph	HSSD = 495' - ODOT 201.2
I-71 SB	87+60.00						7.00% (5.00%)			Max Grade = 5% - ODOT 203.2
I-71 SB	92+73.18	45 mph (55)			360' (495')	61.4 (114)				K >= 114 - ODOT 203-3
I-71 SB	100+40.00						7.00% (5.00%)			Max Grade = 5% - ODOT 203.2
I-71 SB	106+20.00						6.98% (5.00%)			Max Grade = 5% - ODOT 203.2
I-71 SB	109+70.00						5.61% (5.00%)			Max Grade = 5% - ODOT 203.2
I-71 SB	Entire Segment							4' Right Paved Shoulder (and		Right Paved Shoulder Width >= 10' - ODOT 301.2. & 303.1

Route	Station	Design Met (Required)	Horizontal Dc (Max)	Horizontal SSD (Min)	Vertical SSD (Min)	Vertical K (Min)	Maximum Grade (Required)	Other	Design Speed Existing	Design Criteria
								10' Left Shoulder)		
US 50 EB	180+96.74	40 mph (50)	10°08'27" (6°45'00")						30 mph	Horizontal Curve Radius = 6°45'00" - ODOT 202.3
US 50 EB	180+96.74	38 mph (50)		287' (425')						HSSD = 425' - ODOT 201.2
US 50 EB	195+84.44	45 mph (50)	8°33'06" (6°45'00")						30 mph	Horizontal Curve Radius = 6°45'00" - ODOT 202.3
US 50 EB	195+84.44	39 mph (50)		295' (425')						HSSD = 425' - ODOT 201.2
US 50 EB	199+45.00	40 mph (50)			305' (425')	45.8 (84)			US 50 EB (BLP_U050EB)	K >= 84 As per Design Criteria
US 50 EB	199+45.00						6.47% (5.00%)		US 50 EB (BLP_U050EB)	Max Grade = 5% - ODOT 203.2
US 50 EB	190+35 to 199+42							4' Right Shoulder (and 10' Left Shoulder)	US 50 EB (BLP_U050EB)	Right Paved Shoulder Width at Accel Lane >= 8' - ODOT 301.2. & 303.1
US 50 WB	180+33.15	40 mph (50)	11°41'35" (6°45'00")							Horizontal Curve Radius = 6°45'00" - ODOT 202.3
US 50 WB	180+33.15	32 mph (50)		219’ (425’)						HSSD = 425' - ODOT 201.2
US 50 WB	196+34.73	45 mph (50)	8°33'06" (6°45'00")							Horizontal Curve Radius = 6°45'00" - ODOT 202.3
US 50 WB	196+34.73	37 mph (50)		273’ (425’)						HSSD = 425' - ODOT 201.2
US 50 WB	201+90.00	40 mph (50)			305’ (425’)	44.72 (84)				K >= 61 as per Design Criteria

Route	Station	Design Met (Required)	Horizontal Dc (Max)	Horizontal SSD (Min)	Vertical SSD (Min)	Vertical K (Min)	Maximum Grade (Required)	Other	Design Speed Existing	Design Criteria
US 50 WB	204+50.00	40 mph (50)					6.68% (5.0%)			Max Grade = 5% - ODOT 203.2
I-71 SB to SB CD	286+62.84	40 mph (45)	11°30'19" (9°00'00")						OH - I-71 SB to SB CD (Ramp C)	Horizontal Curve Radius = 9°00'00" - ODOT 202.3
I-71 SB to SB CD	286+62.84	38 mph (45)		252' (360')					OH - I-71 SB to SB CD (Ramp C)	HSSD = 360' - ODOT 201.2
I-71 SB to SB CD	287+00.00	40 mph (45)			314' (360')	45.66 (61)			OH - I-71 SB to SB CD (Ramp C)	K >= 61 As per Design Criteria
I-71 SB to SB CD	292+60.00						7.25% (5.00%)		OH - I-71 SB to SB CD (Ramp C)	Max Grade = 5% - ODOT 503.3
I-71 SB to SB CD	296+12 to 298+68280+32 to 291+62							Min 3' Shoulder Width at the east tie-in area.Switch inside and outside shoulder at curved section.	OH - I-71 SB to SB CD (Ramp C)	Right Shoulder Width >= 10' - ODOT 301.2. & 303.1
3RD ST WB to OH-I71 SB CD	315+60 to 318+60							Min 4' Right Shoulder Width	3RD ST WB to OH-I71 SB CD (Ramp D/BLP_RD)	Right Shoulder Width >= 10' - ODOT 301.2. & 303.1

Route	Station	Design Met (Required)	Horizontal Dc (Max)	Horizontal SSD (Min)	Vertical SSD (Min)	Vertical K (Min)	Maximum Grade (Required)	Other	Design Speed Existing	Design Criteria
NB CD to I-71 NB	225+83.72	42 mph (45)		335' (360')					OH - NB CD to I-71 NB (Ramp A/BLP_RA)	HSSD = 360' - ODOT 201.2
NB CD to I-71 NB	222+80.00						7.00% (5.00%)		OH - NB CD to I-71 NB (Ramp A/BLP_RA)	Max Grade = 5% - ODOT 503.3
NB CD to I-71 NB	226+96.18	35 mph (45)			251' (360')	29.12 (61)	-	-	OH - NB CD to I-71 NB (Ramp A/BLP_RA)	K >= 61 As per Design Criteria
NB CD	136+09.08	51 MPH (55)		443' (495')					NB CD (BLP_RCD NB)	HSSD = 495' - ODOT 201.2
NB CD	148+63.11	54 MPH (55)		484' (495')					NB CD (BLP_RCD NB)	HSSD = 495' - ODOT 201.2
NB CD	158+88.21	48 MPH (55)		405' (495')					NB CD (BLP_RCD NB)	HSSD = 495' - ODOT 201.2
NB CD	141+53.78	44 MPH (55)			350' (360')	58.91 (114)			NB CD (BLP_RCD NB)	K >=114 As per Design Criteria
NB CD	137+50						5.09% (5.00%)		NB CD (BLP_RCD NB)	Max Grade = 5% - ODOT 503.3
NB CD	Existing BSB Bridge Deck							Min shoulder width 4' (Lt) and 7.79' (Rt)	NB CD (BLP_RCD NB)	Right Shoulder Width >= 10' - ODOT 301.2. & 303.1

Route	Station	Design Met (Required)	Horizontal Dc (Max)	Horizontal SSD (Min)	Vertical SSD (Min)	Vertical K (Min)	Maximum Grade (Required)	Other	Design Speed Existing	Design Criteria
SB CD to EB 50	363+81.82	30 MPH (40)			209' (305')	19.57 (44)			SB CD to EB 50 (Ramp J/BLP_RJ)	K >=44 As per Design Criteria
NB CD to WB 50	324+09.84	33 mph (35)		232' (360')					NB CD to WB 50 (Ramp E/BLP_RE)	HSSD = 250' - ODOT 201.2
NB CD to WB 50	318+02 to 335+36							Switch inside and outside shoulder at curved section.	NB CD to WB 50 (Ramp E/BLP_RE)	Right Shoulder Width >= 6' - ODOT 301.2. & 303.1
US 50E to SB CD	450+55.90	30 mph (45)		201' (360')					OH- US 50E to SB CD (Ramp O/BLP_RO)	HSSD = 360' - ODOT 201.2
US 50E to SB CD	450+55.90	31 mph (45)	16°22'13" (9°00'00")						OH- US 50E to SB CD (Ramp O/BLP_RO)	Horizontal Curve Radius = 9°00'00" - ODOT 202.3
US 50E to SB CD	449+60.00	40 mph (45)			311' (360')	44.52 (61)			OH- US 50E to SB CD (Ramp O/BLP_RO)	K >=61 As per Design Criteria
SB CD	164+08.54	51 MPH (55)		448' (495')					SB CD (BLP_RCD SB)	HSSD = 495' - ODOT 201.2
WB 50 to NB CD	405+25.03	36 MPH (45)		266' (360')					WB 50 to NB CD	HSSD = 360' - ODOT 201.2

Route	Station	Design Met (Required)	Horizontal Dc (Max)	Horizontal SSD (Min)	Vertical SSD (Min)	Vertical K (Min)	Maximum Grade (Required)	Other	Design Speed Existing	Design Criteria
									(Ramp L/BLP_RL)	
WB 50 to NB CD	405+25.03	40 MPH (45)	10°30'47" (9°00'00")						WB 50 to NB CD (Ramp L/BLP_RL)	Horizontal Curve Radius = 9°00'00" - ODOT 202.3
WB 50 to NB CD	400+70.18	42 MPH (45)			325' (360')	48.97 (61)			WB 50 to NB CD (Ramp L/BLP_RL)	K >= 61 - ODOT 203-3
WB 50 to NB CD	406+24.70	42 MPH (45)			336' (360')	44.30 (61)			WB 50 to NB CD (Ramp L/BLP_RL)	K >= 61 - ODOT 203-3
WB 50 to NB CD	424+89.95	46 MPH (55)		383' (495')					WB 50 to NB CD (Ramp L/BLP_RL)	HSSD = 495' - ODOT 201.2
3RD ST WB to NB CD	543+24.33	25 mph (30)			161' (200')	12.00 (19)			3RD ST WB to NB CD (Ramp U/BLP_RU)	K >= 19 - ODOT 203-3
3RD ST to NB CD	575+62.30	27 mph (30)			170' (200')	14.05 (19)			3RD ST to NB CD (Ramp V/BLP_RV)	K >= 19 - ODOT 203-3

11. COMPLIANCE WITH FHWA POLICY REQUIREMENTS

FHWA provides guidance in the *Policy on Access to the Interstate System* dated May 22, 2017, which details two policy requirements the states must follow when seeking FHWA approval for a change in access to the interstate system. This section discusses each policy requirement as it relates to the BSB Corridor.

11.1 Policy Requirement #1

"An operational and safety analysis has concluded that the proposed change in access does not have a significant adverse impact on the safety and operation of the Interstate facility (which includes mainline lanes, existing, new, or modified ramps, and ramp intersections with crossroad) or on the local street network based on both the current and the planned future traffic projections. The analysis should, particularly in urbanized areas, include at least the first adjacent existing or proposed interchange on either side of the proposed change in access (Title 23, Code of Federal Regulations (CFR), paragraph 625.2(a), 655.603(d) and 771.111(f)). The crossroads and the local street network, to at least the first major intersection on either side of the proposed change in access, should be included in this analysis to the extent necessary to fully evaluate the safety and operational impacts that the proposed change in access and other transportation improvements may have on the local street network (23 CFR 625.2(a) and 655.603(d)). Requests for a proposed change in access should include a description and assessment of the impacts and ability of the proposed changes to safely and efficiently collect, distribute, and accommodate traffic on the Interstate facility, ramps, intersection of ramps with crossroads, and local street network (23 CFR 625.2(a) and 655.603(d)). Each request should also include a conceptual plan of the type and location of the signs proposed to support each design alternative (23 U.S.C. 109(d) and 23 CFR 655.603(d))."

Policy Requirement #1 - Traffic operational and safety analysis was completed to compare Refined Alternative I (Concept I-W) to Build Innovations. The analysis was completed using a calibrated TransModeler model that was approved by ODOT, KYTC, and FHWA in 2023. The Refined Alternative I (Concept I-W) model was also finalized in 2023. The TransModeler model was updated for the Build Innovation design and evaluated using the same procedures as the 2023 IMS addendum. The operational results indicate that Build Innovations will provide acceptable traffic operations and have operations on the freeway mainlines, C-D roads, ramp terminals, and adjacent arterials at levels similar to Refined Alternative I (Concept I-W). Section 8 compares the operations between the two alternatives and demonstrates that operations are not degraded compared to Refined Alternative I (Concept I-W).

The safety analysis evaluates the most recent 5 years of crash data to identify existing safety concerns. A predictive safety analysis was completed to evaluate the safety differences between the two alternatives in the project areas that are impacted by the innovation design changes, which include BSB project phases III and II. The safety analysis indicates similar overall predicted crashes for the two alternatives. The Build Innovations decreases the freeway mainline crashes due to cross-section enhancements on the Companion Bridge and other alignment and lane improvements that optimize traffic operations. Build Innovations experiences some increase in C-D road crashes and intersection crashes due to increased exposure to these facilities. The overall C-D road lengths were increased with Build Innovations during design refinements for Build Innovations. Furthermore, additional intersections were added to Build Innovations to enhance pedestrian connectivity in downtown Cincinnati, which led to fewer direct service ramps and more arterial intersections to facilitate access to and from I-71/I-75. The safety analysis that is summarized in **Section 8** confirms

that Build Innovations will maintain an acceptable level of safety as compared to Refined Alternative I (Concept I-W).

The conceptual signing plan, described in **Section 3.4** and shown in **Appendix A**, illustrates the general types and locations of signs intended to support the proposed design alternative. While the conceptual plan does not currently comply with the MUTCD guidelines, all traffic control devices installed on publicly traveled roadways will be fully compliant at the time of project delivery. The engineer of record and project delivery team will ensure adherence to all applicable standards.

11.2 Policy Requirement #2

"*The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" may be considered on a case-by-case basis for applications requiring special access, such as managed lanes (e.g., transit or high occupancy vehicle and high occupancy toll lanes) or park and ride lots. The proposed access will be designed to meet or exceed current standards (23 CFR 625.2(a), 625.4(a)(2), and 655.603(d)). In rare instances where all basic movements are not provided by the proposed design, the report should include a full-interchange option with a comparison of the operational and safety analyses to the partial interchange option. The report should also include the mitigation proposed to compensate for the missing movements, including wayfinding signage, impacts on local intersections, mitigation of driver expectations leading to wrong-way movements on ramps, etc. The report should describe whether the future provision of a full interchange is precluded by the proposed design.*"

Policy Requirement #2 -. The proposed C-Ds and frontage roads allow for multiple points of access and connectivity in Ohio and Kentucky through local arterials. The ramp modifications in Cincinnati provide acceptable access in and out of the central business district. The operations analysis indicates these ramp modifications result in acceptable LOS for Build Innovations.

The project will be developed to meet current design standards. Where current standards cannot be met, a design exception will be fully developed, vetted for that location, and approved using state procedures.

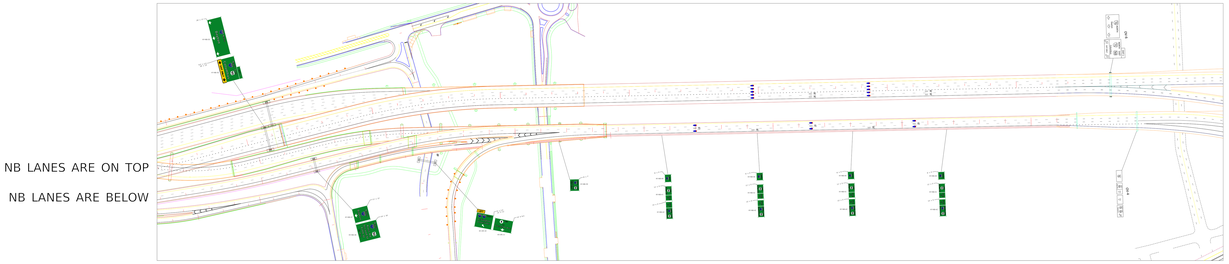
12. CONCLUSION

The BSB IMS Addendum aims to confirm that the innovations that modify Refined Alternative I (Concept I-W) result in acceptable operations and safety. The operations and safety analysis compares the Refined Alternative I (Concept I-W) to Build Innovations and provides documentation to substantiate that the innovations do not adversely impact operations or safety.

The operations of the BSB corridor are improved significantly in both Refined Alternative I (Concept I-W) and Build Innovations due to the removal of the bridge capacity constraint over the Ohio River. This allows for free flow traffic conditions on the freeway mainline throughout the project area, a significant operational improvement compared to existing conditions. Additionally, the design modification for Build Innovations results in acceptable traffic operations for the C-D roadway, ramp terminal intersections, and adjacent arterial streets. Overall, the Refined Alternative I (Concept I-W) achieves the operational goals of the project's purpose and need.

The safety of the BSB Corridor is improved in both Refined Alternative I (Concept I-W) and Build Innovations compared to the existing conditions due to designs that alleviate capacity constraints and correct geometric deficiencies that contribute to existing crash conditions. These designs meet current standards for curves and shoulders, reduce weaving by separating mainline and local traffic, and eliminate left exits on the freeway mainline. The predictive safety analysis indicates a similar level of safety for Refined Alternative I (Concept I-W) and Build Innovations.

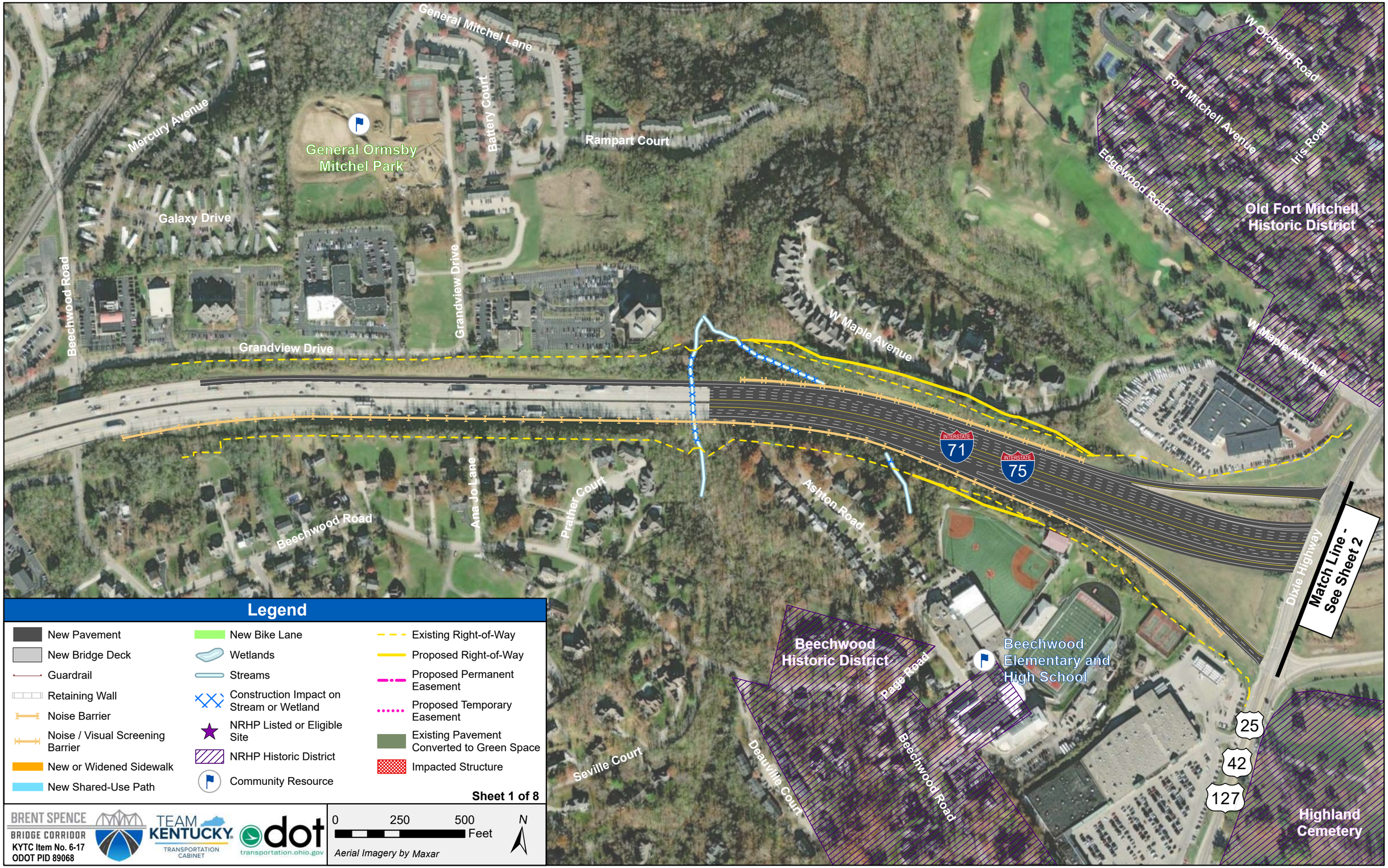
Appendix A:
Build Innovation Signing Plan



NORTHBOUND

SOUTHBOUND

Appendix B:
BSB Corridor Refined Alternative I (Concept I-W) Plan



Legend

- New Pavement
- New Bridge Deck
- Guardrail
- Retaining Wall
- Noise Barrier
- Noise / Visual Screening Barrier
- New or Widened Sidewalk
- New Shared-Use Path
- New Bike Lane
- Wetlands
- Streams
- Construction Impact on Stream or Wetland
- NRHP Listed or Eligible Site
- NRHP Historic District
- Community Resource
- Existing Right-of-Way
- Proposed Right-of-Way
- Proposed Permanent Easement
- Proposed Temporary Easement
- Existing Pavement Converted to Green Space
- Impacted Structure

Sheet 1 of 8

BRENT SPENCE BRIDGE CORRIDOR
KYTC Item No. 6-17
ODOT PID 89068

TEAM KENTUCKY TRANSPORTATION CABINET

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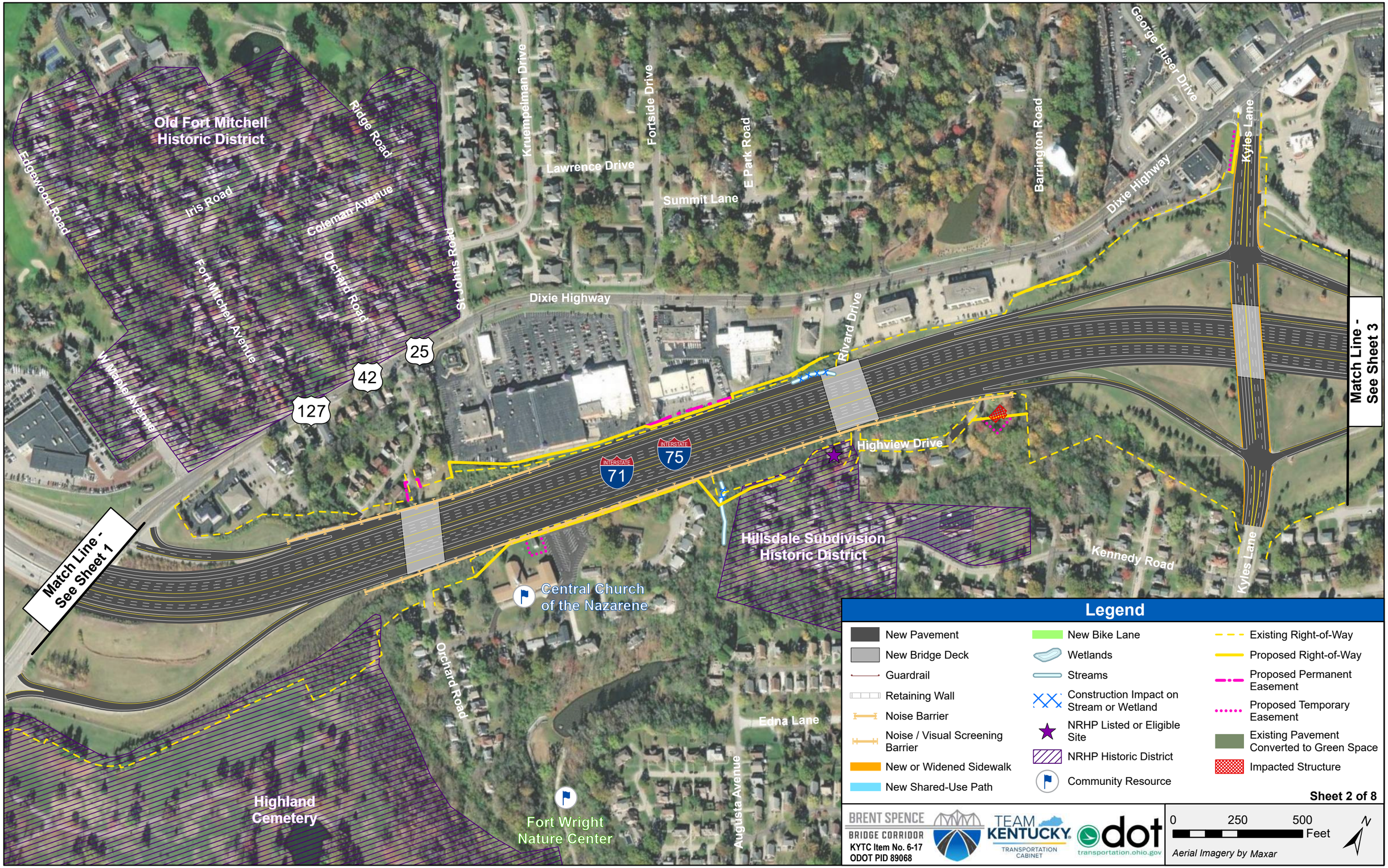
Aerial Imagery by Maxar



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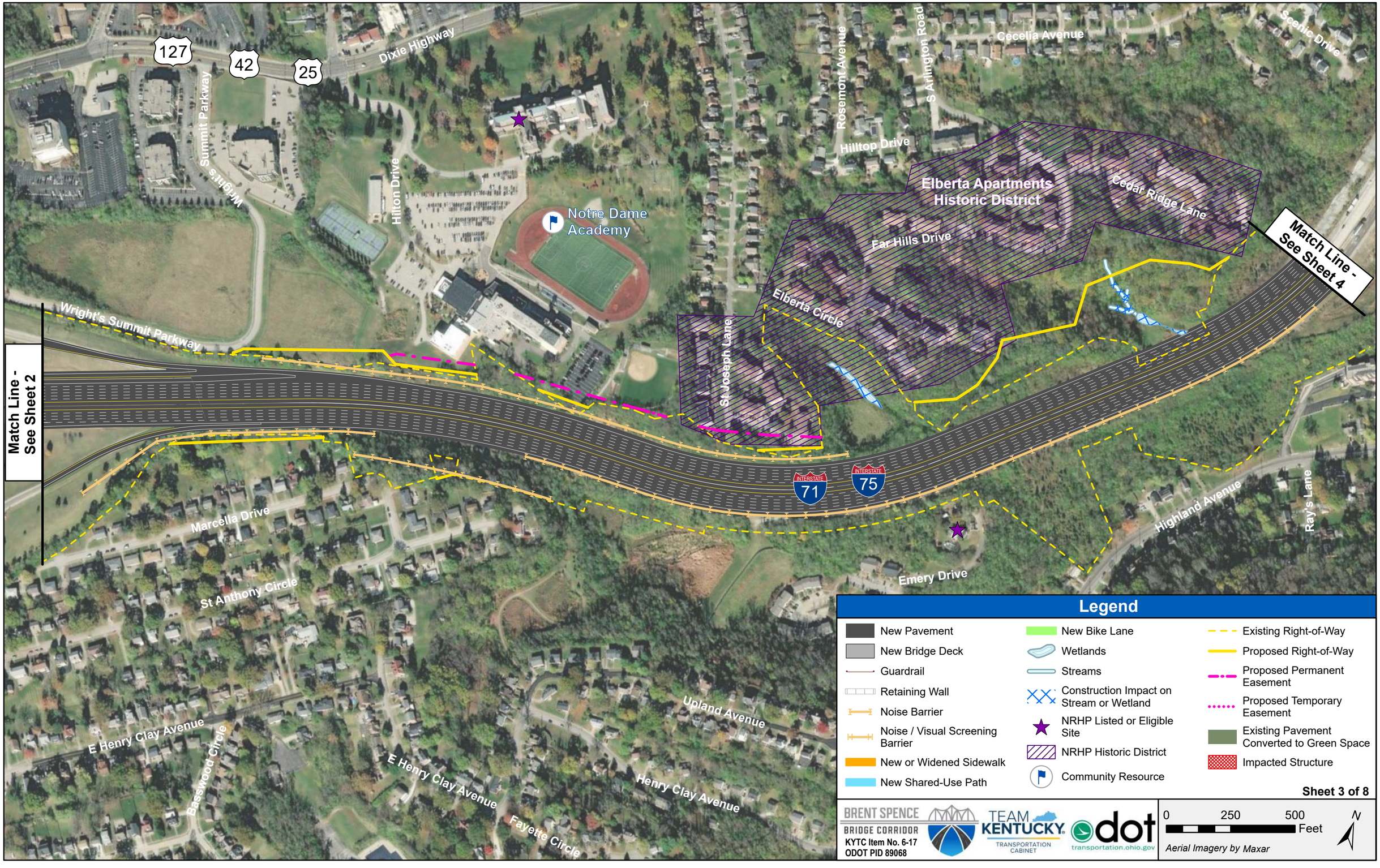

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Sheet 4 of 8

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Aerial Imagery by Maxar

Match Line - See Sheet 5

Match Line - See Sheet 3

Irishrose Lane
Cecelia Avenue
Scenic Drive
Scenic Drive
Elberta Apartments Historic District
W Pike Street
Montague Road
Western Avenue
W 9th Street
Crescent Avenue
Lewis Street
Baker Street
Lewisburg Historic District
Prince of Peace Catholic School
Neighborhood Park
Southgate Street
25
42
127
W 11th Street
W 12th Street
Watkins Street
Hermes Avenue
Impacted Structure
Willow Run Road
W 9th Street
Philadelphia Street
Mainstrasse Historic District
York Street
Bullock Street
Simon Kenton Way
INTERSTATE 75
INTERSTATE 71
W Pike Street
Watkins Street
Main Street
W 11th Street
James Simpson Jr Way
Kavanaugh Street
St. Elizabeth Covington Hospital
Garden of Hope
Edgecliff Road
Monroe Street
W 16th Street
Linden Avenue
Linden Grove Cemetery & Arboretum
W 13th Street
MLK Jr. Boulevard
Lee Street
Holman Street
Ivy Knoll Senior Living Community

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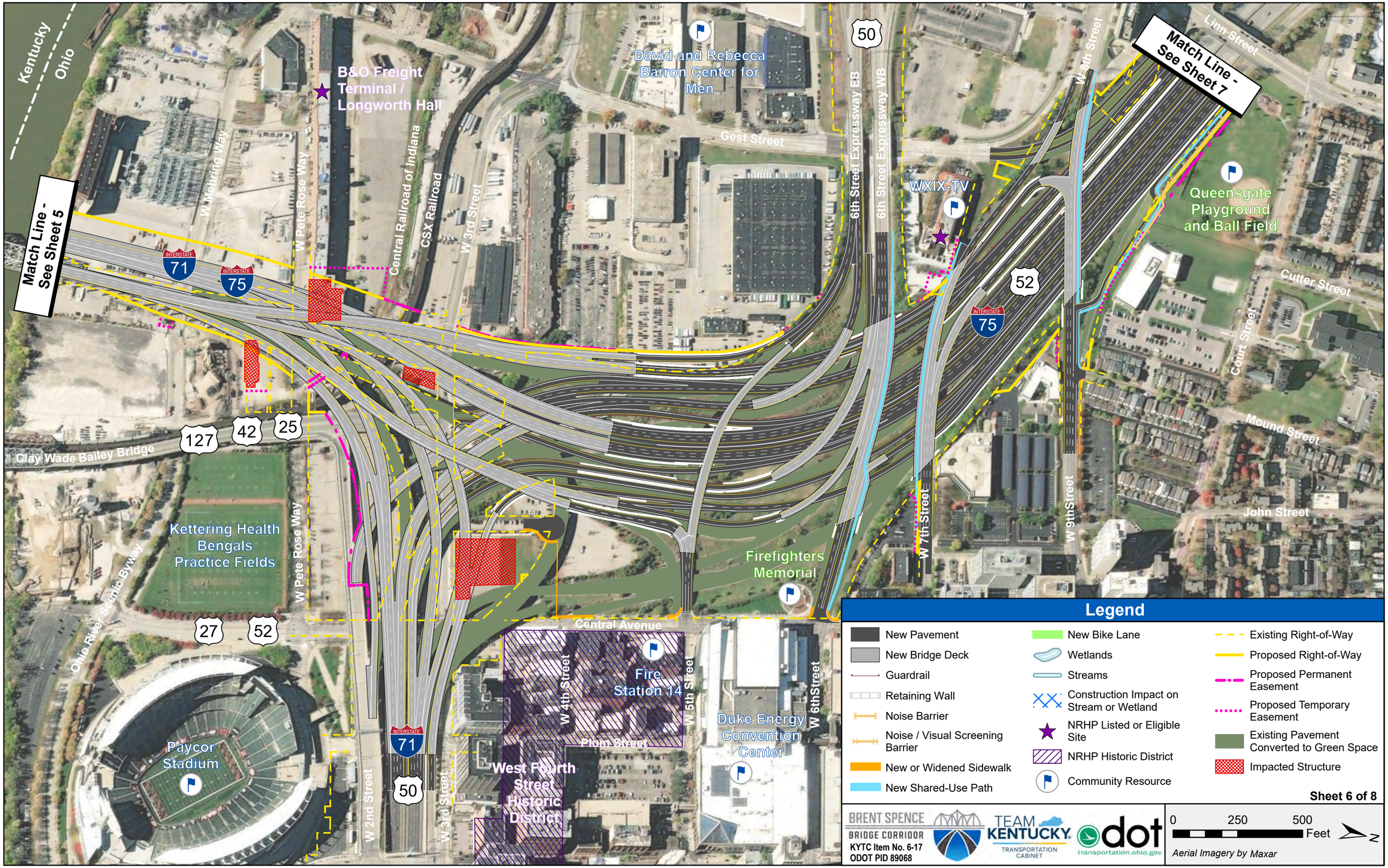
Aerial Imagery by Maxar



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Aerial Imagery by Maxar

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BRENT SPENCE BRIDGE CORRIDOR
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Aerial Imagery by Maxar

Cincinnati Union Terminal
Dalton Avenue
Post Office
Findlay Street
Match Line - See Sheet 8
Lincoln Park - Union Terminal
Liberty Street
Cincinnati Job Corps Center
Western Avenue
Freeman Avenue
W 8th Street
Gest Street
52
INTERSTATE 75
West End Community Garden
Dayton Street Historic District
Winchell Avenue
Highway cap with green space
Lincoln Community Center
CAA Head Start
Ezzard Charles Drive
Wade Walk Baseball Field
Public Library
Sands Playground
Baymiller Street
Linn Street
Match Line - See Sheet 6
St. Joseph Catholic School
Linn Livingston Park
Fire Station 29
Queensgate Playground and Ball Field
Court Street
Clark Street
Ezzard Charles Park
Derrick Turnbow Avenue
Laurel Park Drive
Wade Street
Laurel Playground
Poplar Street
Findlay Street
York Street
John Street
Cutter Street

Legend

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Sheet 8 of 8

BRENT SPENCE BRIDGE CORRIDOR
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Aerial Imagery by Maxar

Connection to City of Cincinnati Western Hills Viaduct project

Western Hills Viaduct

Spring Grove Avenue

Dalton Avenue

Winchell Avenue

Match Line - See Sheet 7

Bank Street

Harrison Avenue

Patterson Street

Dayton Street Historic District

Colerain Avenue

Dyer Park

Central Avenue

Central Parkway

W McMicken Avenue

Klotter Avenue

Conroy Street

Central Parkway

W McMillan Street

West McMicken Avenue Historic District

Halstead Street

Western Hills Viaduct Subway Tunnel Portals

W McMicken Avenue

W McMillan Street

Fairview Park Road

Straight Street

Draper Street

Alfred Street

Cook Street

Straight Street

Colerain Avenue

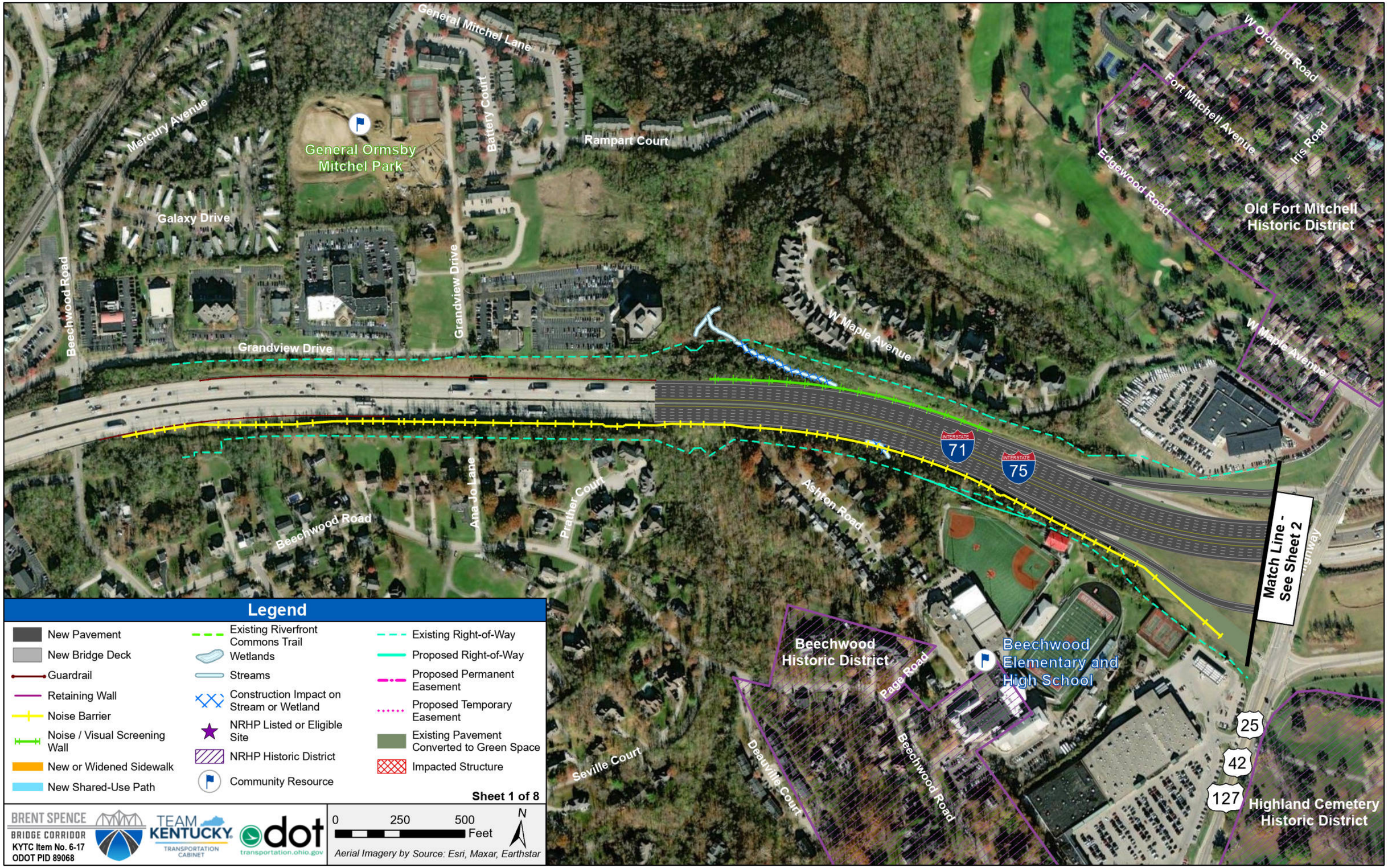
52

75

127

27

Appendix C:
BSB Corridor Build Innovation Plan



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BRENT SPENCE BRIDGE CORRIDOR
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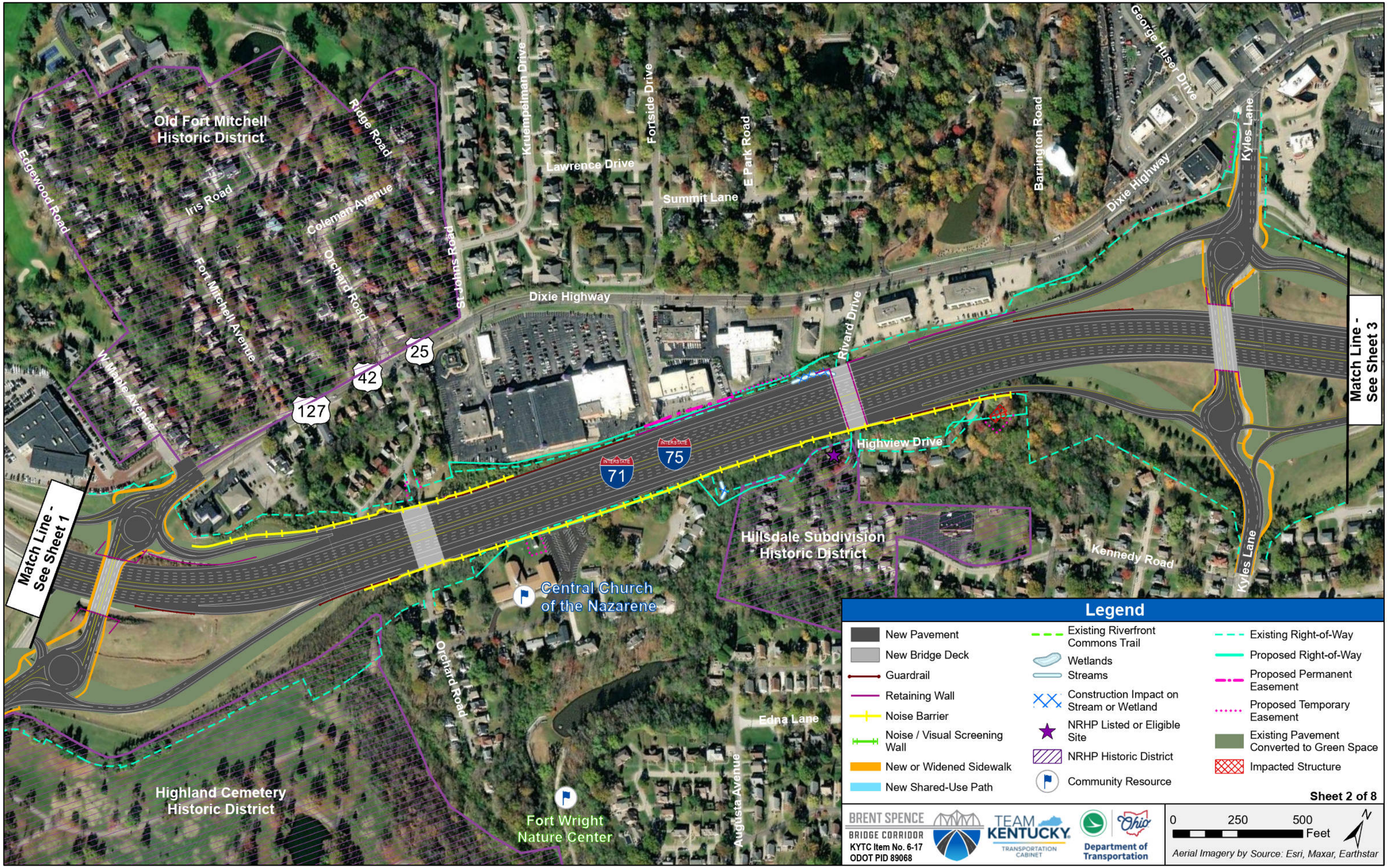
Aerial Imagery by Source: Esri, Maxar, Earthstar


Old Fort Mitchell
Historic District
Edgewood Road
Ridge Road
Iris Road
Coleman Avenue
Fort Mitchell Avenue
Orchard Road
St. Johns Road
W. Maple Avenue
Kruempelman Drive
Lawrence Drive
Fortside Drive
Summit Lane
E Park Road
Barrington Road
George Huser Drive
Dixie Highway
Kyles Lane
Rivard Drive
Highview Drive
25
42
127
71
75
INTERSTATE
Match Line - See Sheet 3
Match Line - See Sheet 1
Hillsdale Subdivision
Historic District
Kennedy Road
Central Church
of the Nazarene
Orchard Road
Edna Lane
Augusta Avenue
Highland Cemetery
Historic District
Fort Wright
Nature Center
Legend
New Pavement
New Bridge Deck
Guardrail
Retaining Wall
Noise Barrier
Noise / Visual Screening Wall
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New Shared-Use Path
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Proposed Right-of-Way
Proposed Permanent Easement
Proposed Temporary Easement
Existing Pavement Converted to Green Space
Impacted Structure
Sheet 2 of 8
BRENT SPENCE
BRIDGE CORRIDOR
KYTC Item No. 6-17
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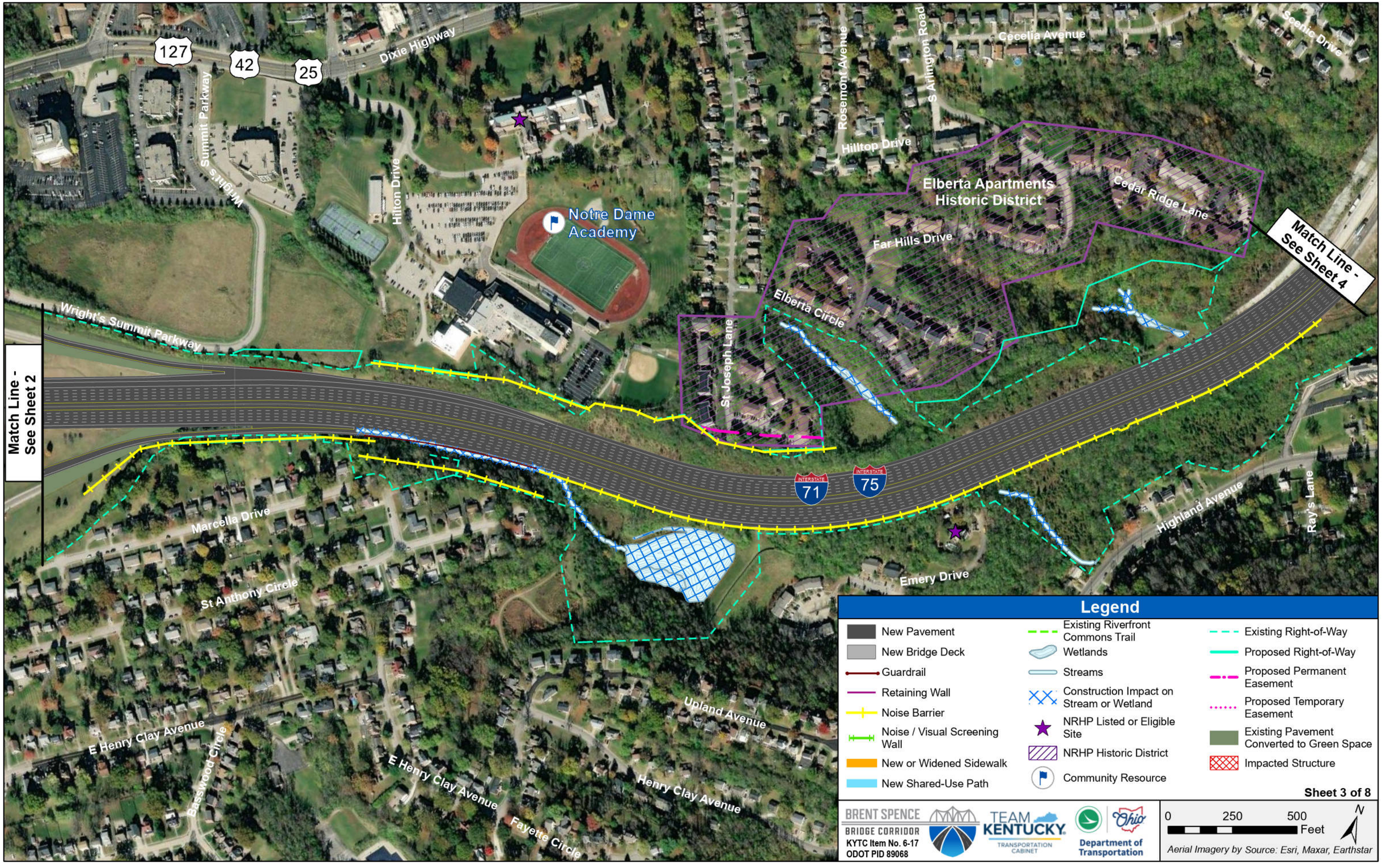
Aerial Imagery by Source: Esri, Maxar, Earthstar



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BRENT SPENCE BRIDGE CORRIDOR
KYTC Item No. 6-17
ODOT PID 89068

TEAM KENTUCKY TRANSPORTATION CABINET

Ohio Department of Transportation

0 250 500 Feet

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Aerial Imagery by Source: Esri, Maxar, Earthstar

Legend

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Ohio Department of Transportation

0 250 500 Feet

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Aerial Imagery by Source: Esri, Maxar, Earthstar

Match Line - See Sheet 5

Match Line - See Sheet 3

Lewisburg Historic District

Prince of Peace Catholic School

Neighborhood Park

Impacted Structure

Mainstrasse Historic District

Elberta Apartments Historic District

St. Elizabeth Covington Hospital

Linden Grove Cemetery & Arboretum

Garden of Hope

Ivy Knoll Senior Living Community

Monastery Road
Western Avenue
W 9th Street
Crescent Avenue
Lewis Street
Baker Street
Southgate Street
W Pike Street
Hermes Avenue
Watkins Street
W 12th Street
W 11th Street
Willow Run Road
Philadelphia Street
Bullock Street
Simon Kenton Way
York Street
Goebel Place
Main Street
W 14th Street
Watkins Street
James Simpson Jr Way
Kavanaugh Street
W 13th Street
M.L.K. Jr. Boulevard
Lee Street
Holman Street
Lincoln Avenue
Edgecliff Road
Monroe Street
W 16th Street
Irishrose Lane
Cecelia Avenue
Scenic Drive

25 42 127 75 71

Devou Park
Devou Drive
Western Avenue
Lewisburg Historic District
Crescent Avenue
Wright Street
Highway Avenue
Western Avenue
Crescent Avenue
W 3rd Street
Ohio River
New Companion Bridge
Existing Brent Spence Bridge
Match Line - See Sheet 6
Match Line - See Sheet 4
INTERSTATE 71
INTERSTATE 75
Area to be incorporated into Goebel Park
Neighborhood Pool
Kenney Shields Park
Dalton Street
Goebel Park
SFC Jason Bishop Memorial Dog Park
Philadelphia Street
Perry Street
Mainstrasse Historic District
Riverfront Commons Trail
W 3rd Street
Philadelphia Street
Covington Levee System
Clay Wade Bailey Bridge
W 5th Street
Bakewell Street
Main Street
127
42
25
CSX Railroad
W 4th Street
Johnson Street
Kentucky
Ohio

Legend

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Sheet 5 of 8

BRENT SPENCE BRIDGE CORRIDOR
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TEAM KENTUCKY TRANSPORTATION CABINET

Ohio Department of Transportation

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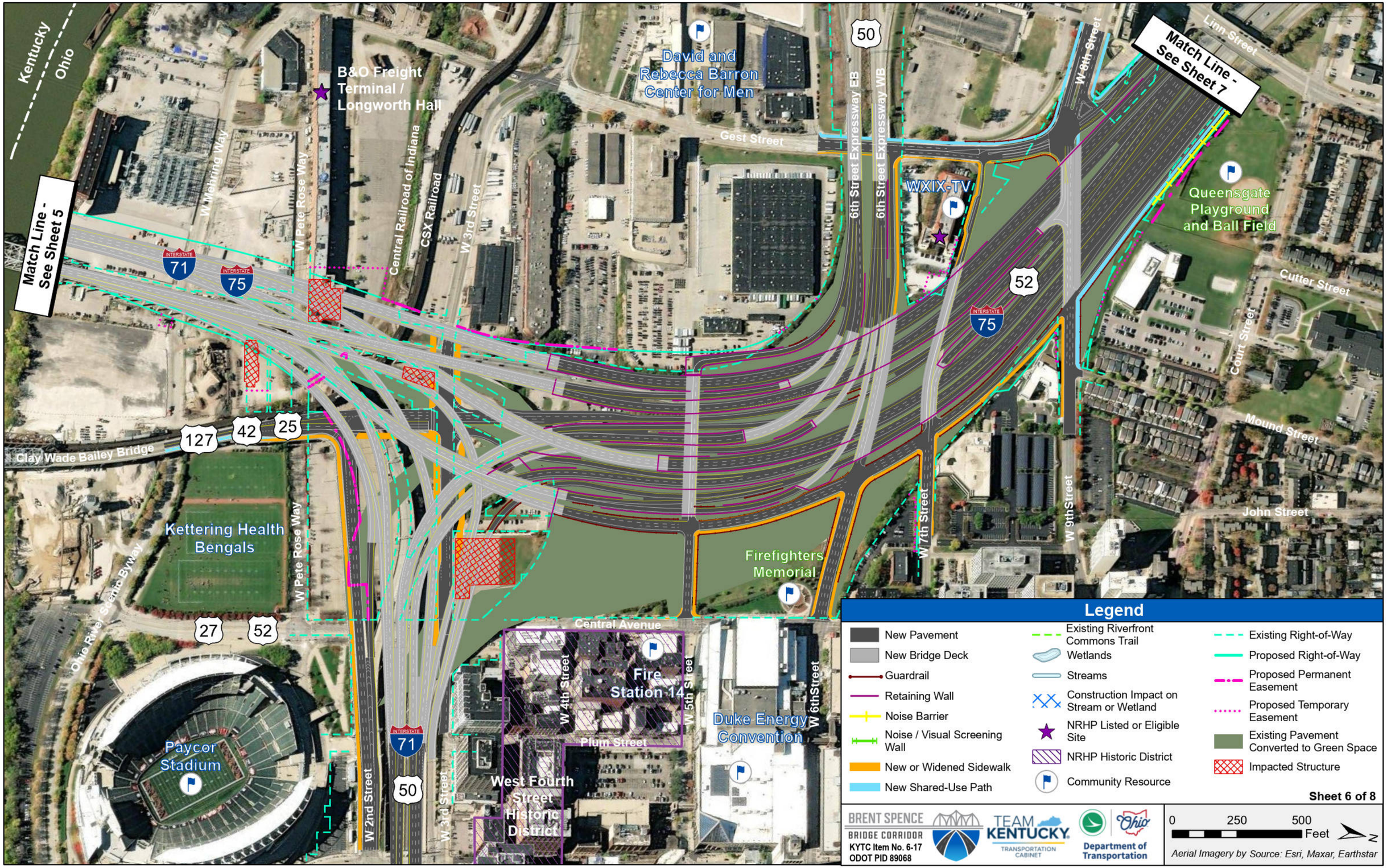
Aerial Imagery by Source: Esri, Maxar, Earthstar



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- Proposed Permanent Easement
- Proposed Temporary Easement
- Existing Pavement Converted to Green Space
- Impacted Structure

BRENT SPENCE BRIDGE CORRIDOR
KYTC Item No. 6-17
ODOT PID 89068

TEAM KENTUCKY TRANSPORTATION CABINET

Ohio Department of Transportation

0 250 500 Feet

N

Aerial Imagery by Source: Esri, Maxar, Earthstar

Legend

- New Pavement
- New Bridge Deck
- Guardrail
- Retaining Wall
- Noise Barrier
- Noise / Visual Screening Wall
- New or Widened Sidewalk
- New Shared-Use Path
- Existing Riverfront Commons Trail
- Wetlands
- Streams
- Construction Impact on Stream or Wetland
- NRHP Listed or Eligible Site
- NRHP Historic District
- Community Resource
- Existing Right-of-Way
- Proposed Right-of-Way
- Proposed Permanent Easement
- Proposed Temporary Easement
- Existing Pavement Converted to Green Space
- Impacted Structure

Sheet 7 of 8

BRENT SPENCE BRIDGE CORRIDOR
KYTC Item No. 6-17
ODOT PID 89068

TEAM KENTUCKY TRANSPORTATION CABINET

Ohio Department of Transportation

0 250 500 Feet N

Aerial Imagery by Source: Esri, Maxar, Earthstar

Cincinnati Union Terminal
Dalton Avenue
Post Office
Findlay Street
Match Line - See Sheet 8
Lincoln Park - Union Terminal
Liberty Street
Cincinnati Job Corps Center
Western Avenue
Freeman Avenue
W 8th Street
Gest Street
52
75
West End Community Garden
Dayton Street Historic District
Winchell Avenue
Highway cap with green space
Sands Playground
Baymiller Street
Lincoln Community Center
CAA Head Start
Public Library
Ezzard Charles Drive
Wade Walk Baseball Field
Liberty Street
Linn Street
Linn Livingston Park
Match Line - See Sheet 6
St. Joseph Catholic School
Fire Station 29
Court Street
Clark Street
Ezzard Charles Park
Derrick Turnbow Avenue
Wade Street
Poplar Street
Findlay Street
York Street
Queensgate Playground and Ball Field
Cutter Street
Laurel Park Drive
Laurel Playground
John Street

Legend

- New Pavement
- New Bridge Deck
- Guardrail
- Retaining Wall
- Noise Barrier
- Noise / Visual Screening Wall
- New or Widened Sidewalk
- New Shared-Use Path
- Existing Riverfront Commons Trail
- Wetlands
- Streams
- Construction Impact on Stream or Wetland
- NRHP Listed or Eligible Site
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- Existing Right-of-Way
- Proposed Right-of-Way
- Proposed Permanent Easement
- Proposed Temporary Easement
- Existing Pavement Converted to Green Space
- Impacted Structure

Sheet 8 of 8

BRENT SPENCE BRIDGE CORRIDOR
KYTC Item No. 6-17
ODOT PID 89068

TEAM KENTUCKY TRANSPORTATION CABINET

Ohio Department of Transportation

0 250 500 Feet

N

Aerial Imagery by Source: Esri, Maxar, Earthstar

Connection to City of Cincinnati Western Hills Viaduct project.

Western Hills Viaduct

Spring Grove Avenue

Dalton Avenue

52

INTERSTATE 75

Winchell Avenue

Match Line - See Sheet 7

Bank Street

Harrison Avenue

Patterson Street

127

27

Dayton Street Historic District

Colerain Avenue

Dyer Park

Central Avenue

Central Parkway

W McMicken Avenue

Klotter Avenue

Conroy Street

Central Parkway

W McMillan Street

West McMicken Avenue Historic District

Halstead Street

Western Hills Viaduct Subway Tunnel Portals

W McMicken Avenue

W McMillan Street

Fairview Park Road

Straight Street

Draper Street

Spring Grove Avenue

Street

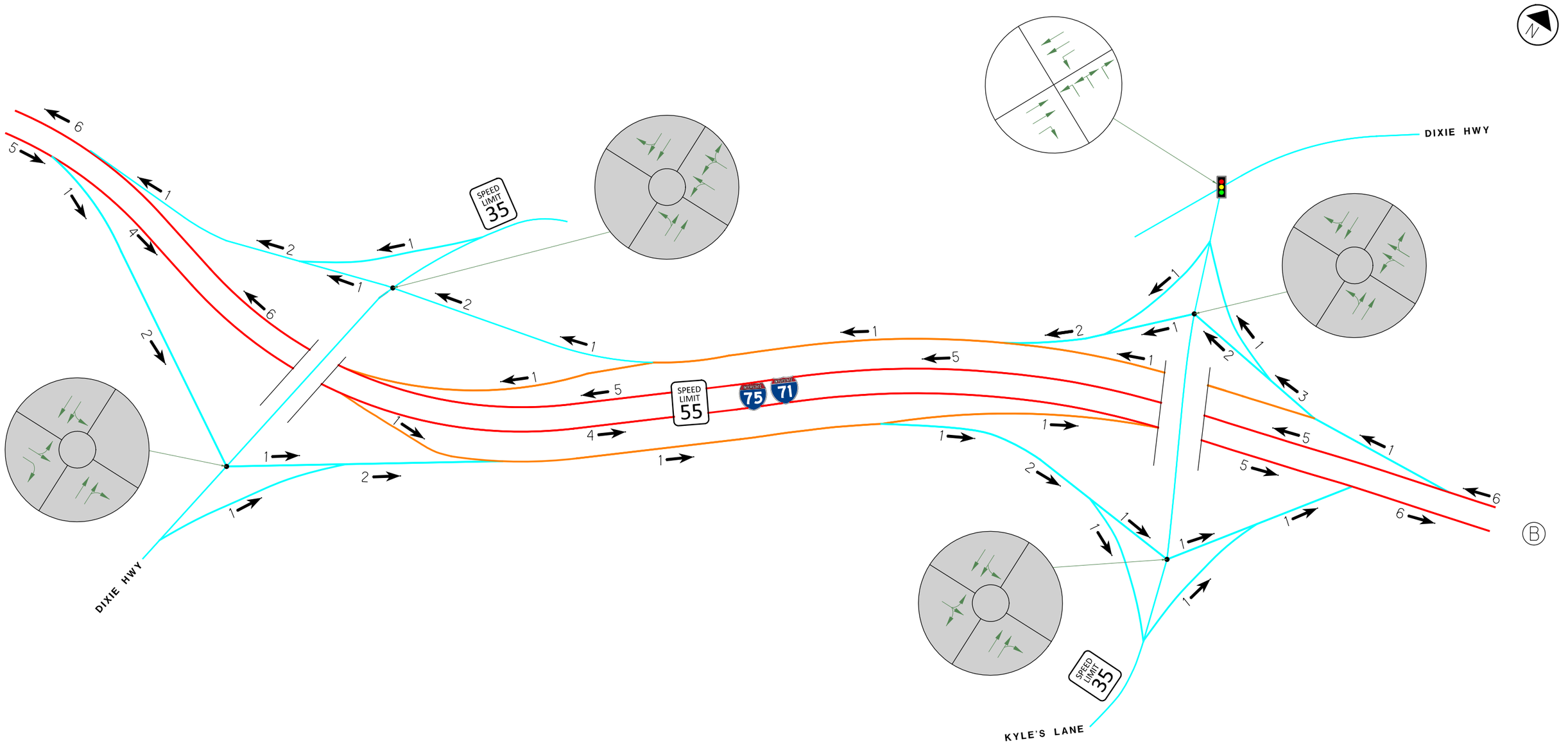
Cook Street

Straight Street

Alfred Street

Colerain Avenue

Appendix D:
Build Innovation Turn Lane Schematic



LEGEND

= INNOVATION INTERSECTION UPDATE

= INTERSECTION CONFIGURATION

X = # OF LANES

I-71/I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

LANE CONFIGURATIONS

PLATE 1 OF 8 (KY)

JUN 2025 | NOT TO SCALE

BUILD INNOVATIONS

HNTB

CRESCENT AVE.

CRESCENT AVE. & 5TH ST.
INTERSECTION REMOVED

BULLOCK ST. & 9TH ST.
INTERSECTION REMOVED

12TH ST.

BULLOCK ST.

SIMON KENTON WAY

PIKE ST.

9TH ST.

MAIN ST.

4TH ST.

PHILADELPHIA ST.

BAKEWELL ST.

5TH ST.

4TH ST.

MAIN ST.

CLAY WADE BAILEY BRIDGE

SPEED LIMIT 25

SPEED LIMIT 30

SPEED LIMIT 55

I-75

I-71

IR-71/IR-75 SB LOWER LEVEL

IR-71/IR-75 NB UPPER LEVEL

LOCAL SB UPPER LEVEL

LOCAL NB LOWER LEVEL

LEGEND

= INNOVATION INTERSECTION UPDATE

= INTERSECTION CONFIGURATION

X = # OF LANES

I-71/I-75

US 50

COLLECTOR-DISTRIBUTOR

LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

LANE CONFIGURATIONS

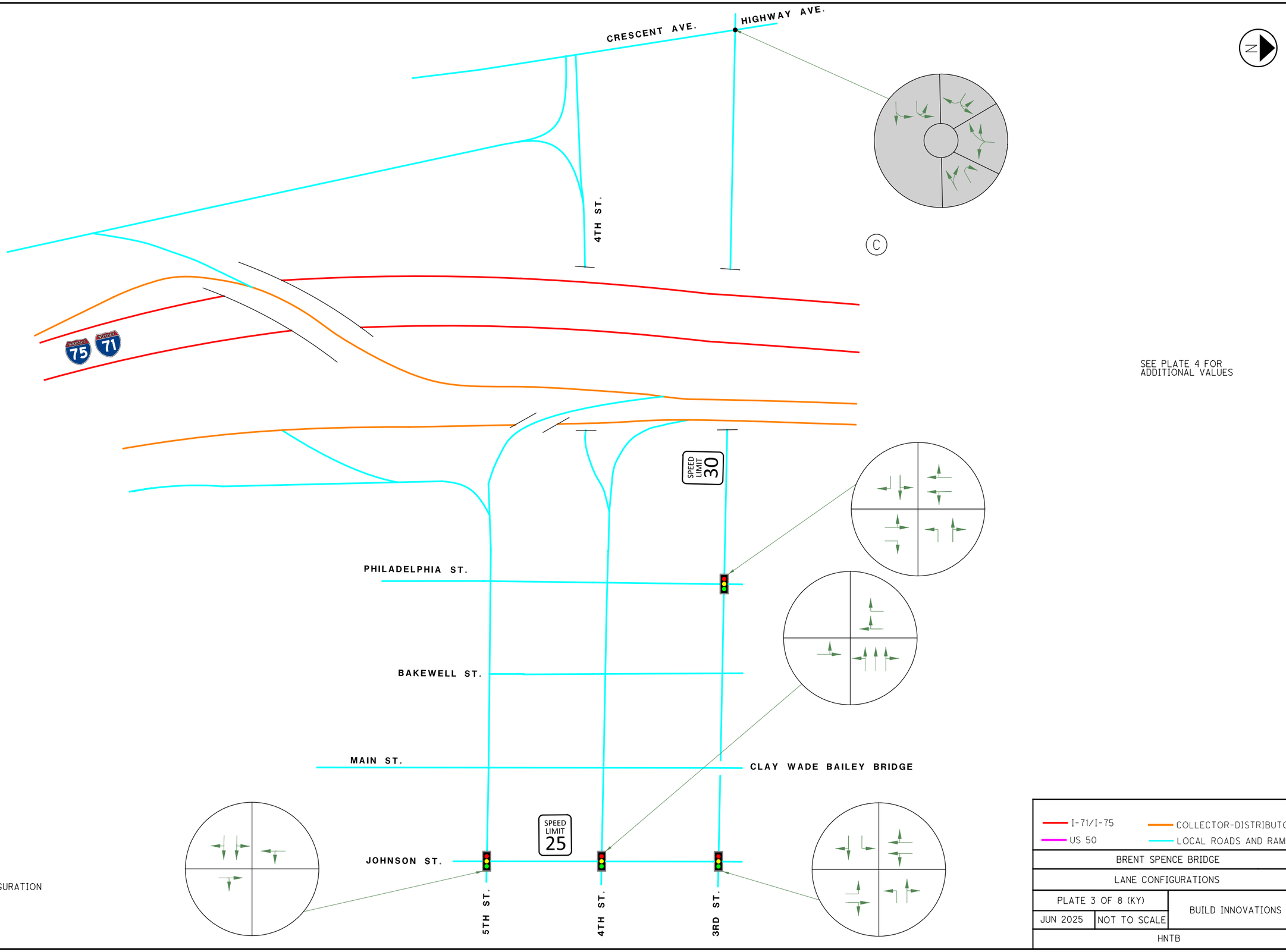
PLATE 2 OF 8 (KY)

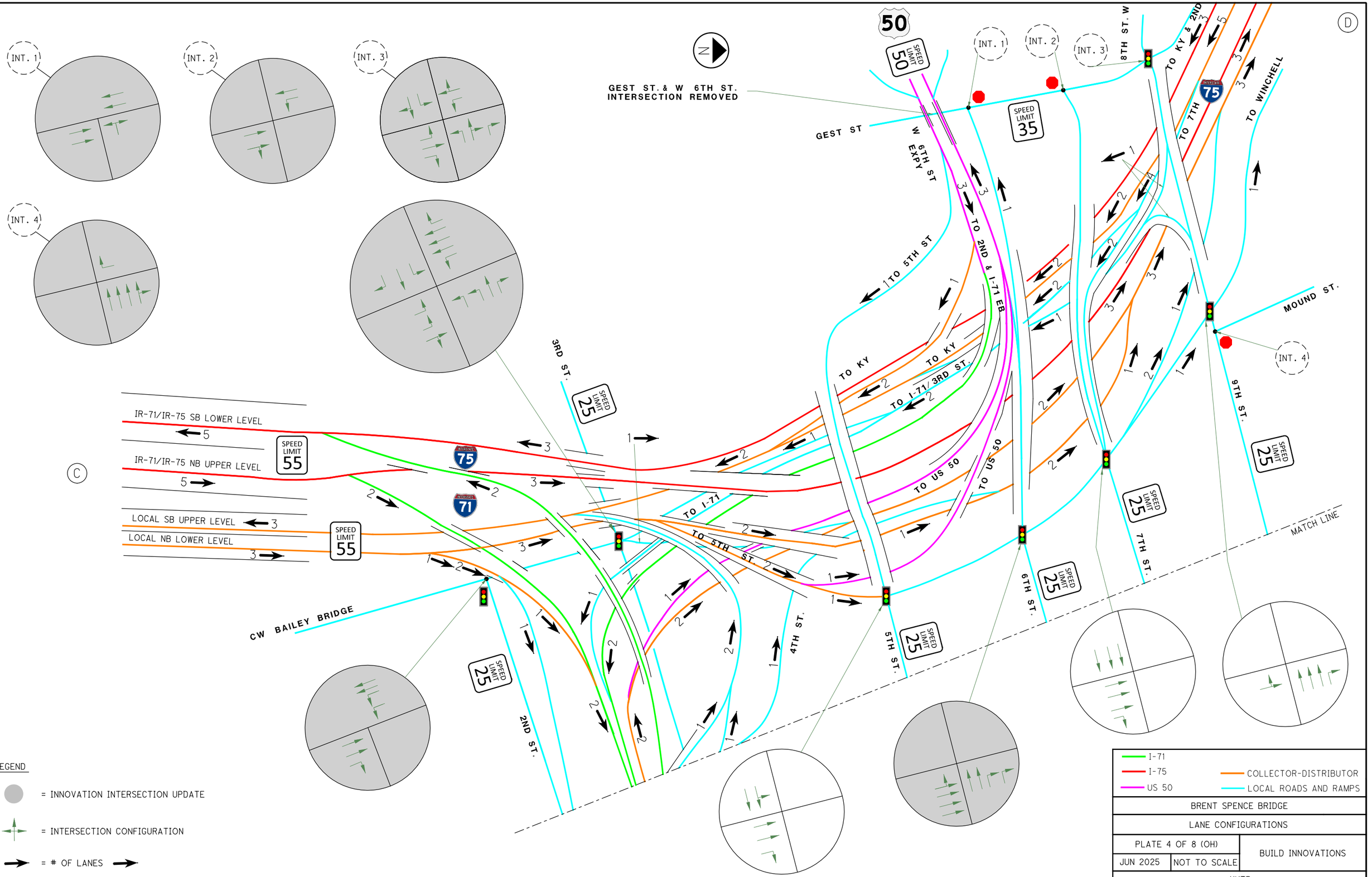
BUILD INNOVATIONS

JUN 2025

NOT TO SCALE

HNTB


CRESCENT AVE.
HIGHWAY AVE.
4TH ST.
C
SEE PLATE 2 FOR ADDITIONAL VALUES
SEE PLATE 4 FOR ADDITIONAL VALUES
SPEED LIMIT 30
PHILADELPHIA ST.
BAKEWELL ST.
MAIN ST.
CLAY WADE BAILEY BRIDGE
SPEED LIMIT 25
JOHNSON ST.
5TH ST.
4TH ST.
3RD ST.
LEGEND
= INTERSECTION CONFIGURATION
X = # OF LANES
I-71/I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
BRENT SPENCE BRIDGE
LANE CONFIGURATIONS
PLATE 3 OF 8 (KY)
JUN 2025
NOT TO SCALE
BUILD INNOVATIONS
HNTB


INT. 1
INT. 2
INT. 3
INT. 4
GEST ST.& W 6TH ST.
INTERSECTION REMOVED
GEST ST
W 6TH EXPY ST
TO 5TH ST
TO 2ND & I-71 EB
TO KY
TO KY
TO I-71/ 3RD ST.
TO US 50
TO US 50
TO I-71
TO 5TH ST
8TH ST. W
TO KY & 2ND
TO 7TH
TO WINCHELL
MOUND ST.
9TH ST.
7TH ST.
6TH ST.
5TH ST.
4TH ST.
3RD ST.
2ND ST.
CW BAILEY BRIDGE
MATCH LINE
IR-71/IR-75 SB LOWER LEVEL
IR-71/IR-75 NB UPPER LEVEL
LOCAL SB UPPER LEVEL
LOCAL NB LOWER LEVEL
SPEED LIMIT 50
SPEED LIMIT 35
SPEED LIMIT 25
SPEED LIMIT 55
INTERSTATE 75
INTERSTATE 71
LEGEND
= INNOVATION INTERSECTION UPDATE
= INTERSECTION CONFIGURATION
X = # OF LANES
I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
BRENT SPENCE BRIDGE
LANE CONFIGURATIONS
PLATE 4 OF 8 (OH)
JUN 2025
NOT TO SCALE
BUILD INNOVATIONS
HNTB

MATCH LINE

CENTRAL AVE.

9TH ST.

7TH ST.

6TH ST.

5TH ST.

4TH ST.

3RD ST.

2ND ST.

ELM ST.

PLUM ST.

RACE ST.

SPEED LIMIT 25

SPEED LIMIT 55

INT. 5

INT. 6

4

2

INTERSTATE 71

50

N

LEGEND

= INNOVATION INTERSECTION UPDATE

= INTERSECTION CONFIGURATION

X = # OF LANES

I-71

I-75

US 50

COLLECTOR-DISTRIBUTOR

LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

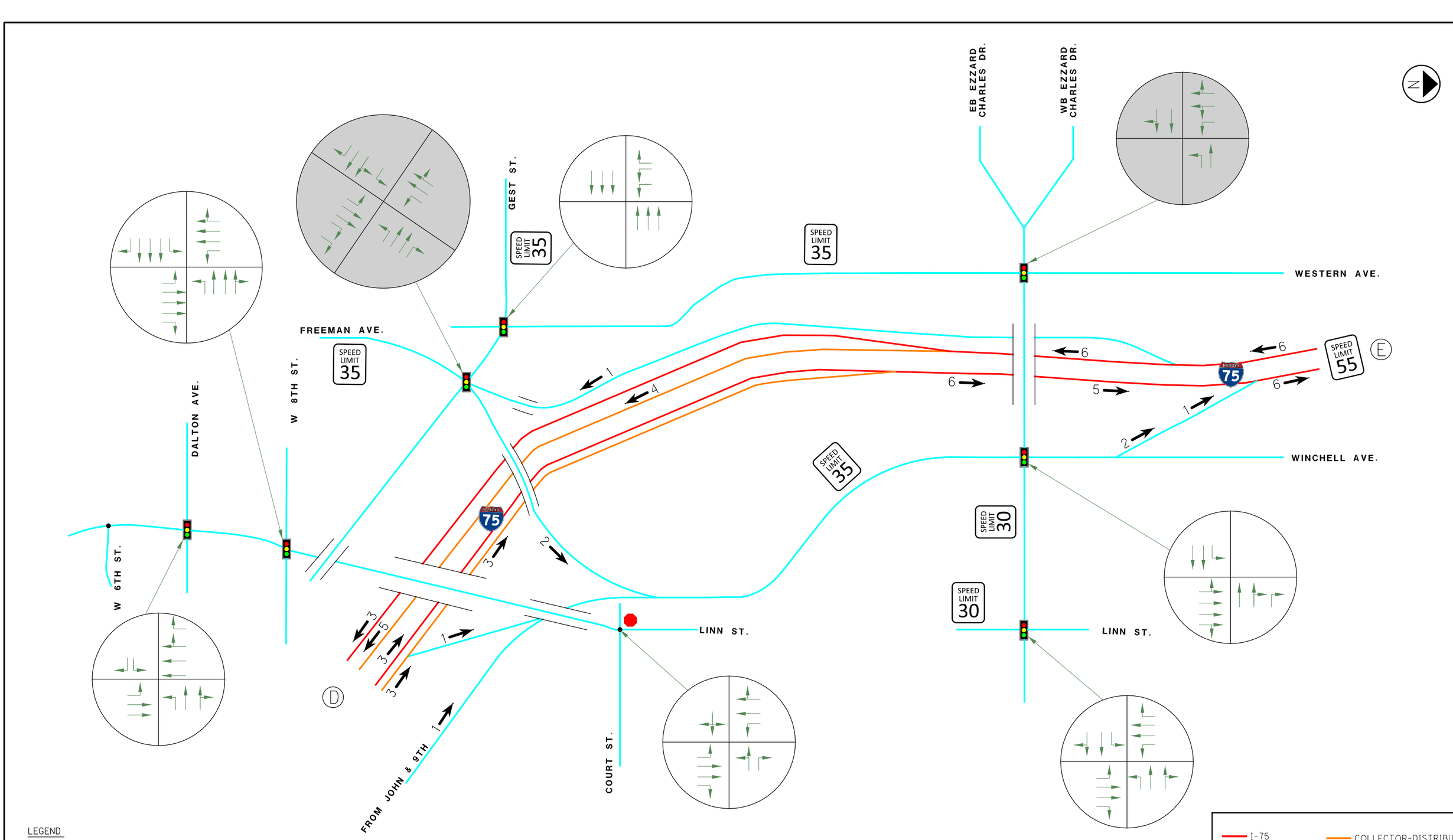
LANE CONFIGURATIONS

PLATE 5 OF 8 (OH)

JUN 2025 | NOT TO SCALE

BUILD INNOVATIONS

HNTB



LEGEND

= INNOVATION INTERSECTION UPDATE

= INTERSECTION CONFIGURATION

X = # OF LANES

I-75

US 50

COLLECTOR-DISTRIBUTOR

LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

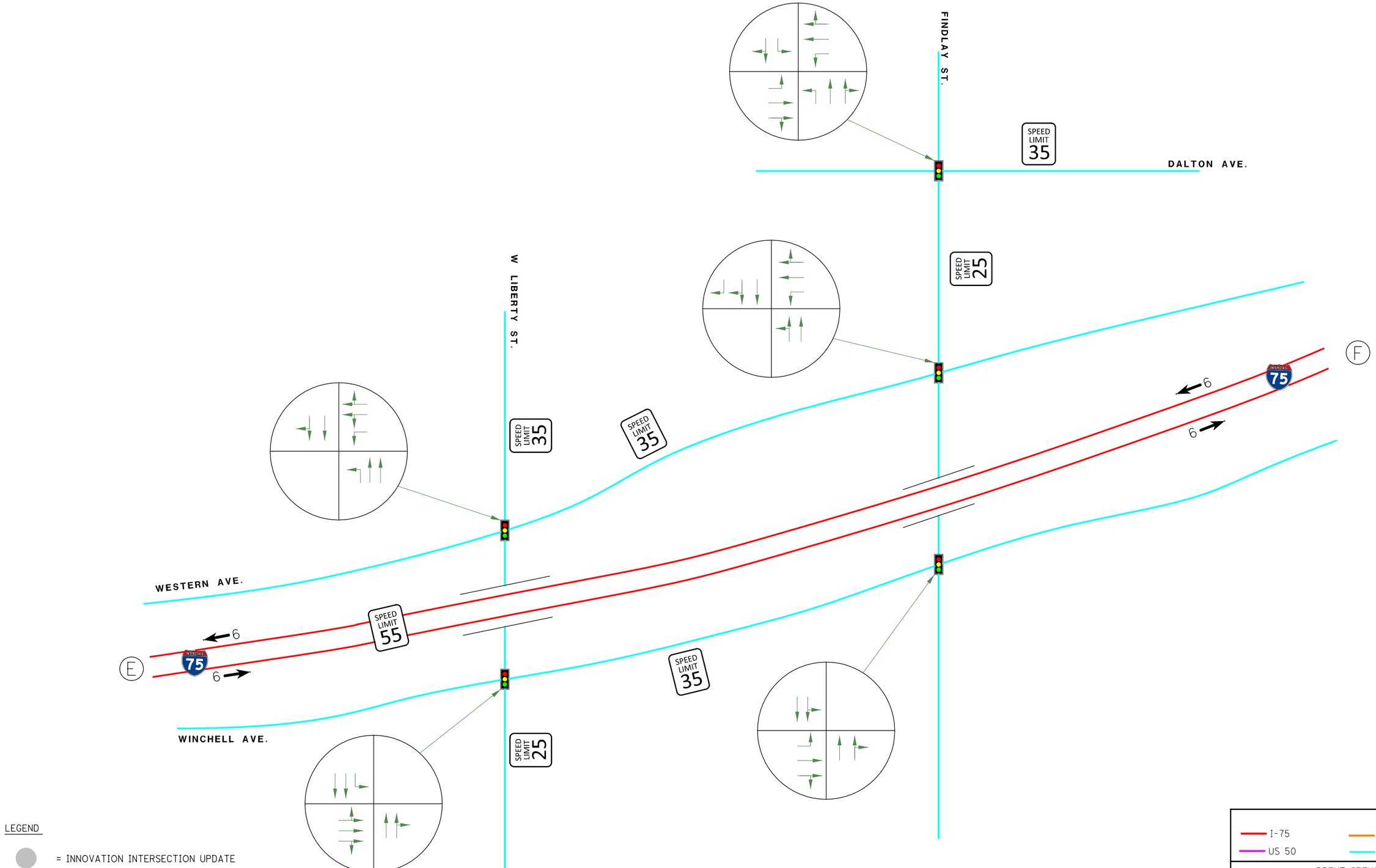
LANE CONFIGURATIONS

PLATE 6 OF 8 (OH)

JUN 2025 | NOT TO SCALE

BUILD INNOVATIONS

HNTB



LEGEND

= INNOVATION INTERSECTION UPDATE

= INTERSECTION CONFIGURATION

X = # OF LANES

I-75

US 50

COLLECTOR-DISTRIBUTOR

LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

LANE CONFIGURATIONS

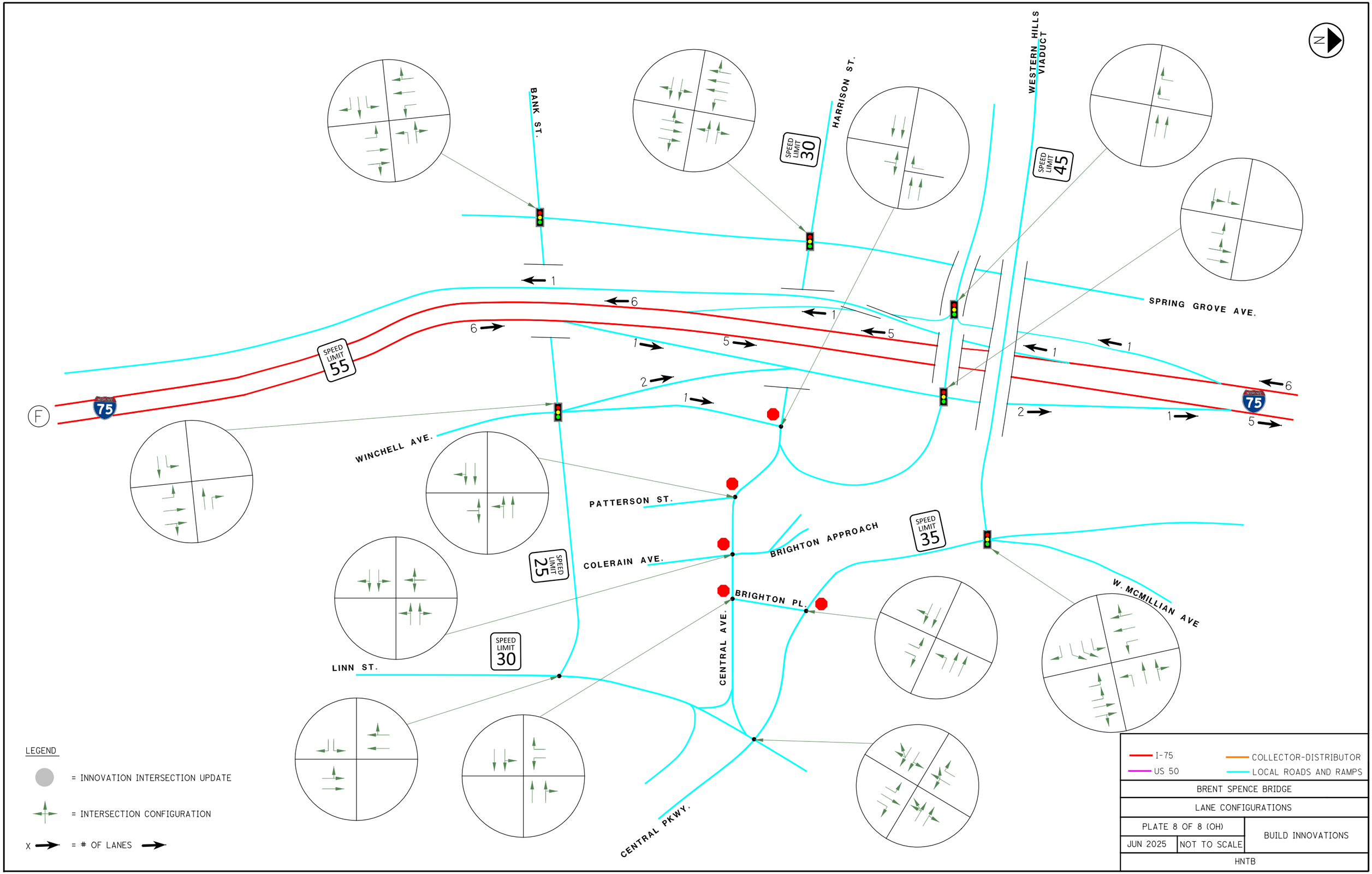
PLATE 7 OF 8 (OH)

JUN 2025

NOT TO SCALE

BUILD INNOVATIONS

HNTB


BANK ST.
HARRISON ST.
WESTERN HILLS VIADUCT
SPRING GROVE AVE.
SPEED LIMIT 30
SPEED LIMIT 45
SPEED LIMIT 55
SPEED LIMIT 25
SPEED LIMIT 35
SPEED LIMIT 30
WINCHELL AVE.
PATTERSON ST.
COLERAIN AVE.
BRIGHTON APPROACH
BRIGHTON PL.
CENTRAL AVE.
W. MCMILLIAN AVE
LINN ST.
CENTRAL PKWY.
INTERSTATE 75
INTERSTATE 75
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1
2
1
6
5
LEGEND
= INNOVATION INTERSECTION UPDATE
= INTERSECTION CONFIGURATION
X = # OF LANES
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
BRENT SPENCE BRIDGE
LANE CONFIGURATIONS
PLATE 8 OF 8 (OH)
JUN 2025
NOT TO SCALE
BUILD INNOVATIONS
HNTB

Appendix E-1:
BSB Certified Traffic Report

BRENT SPENCE BRIDGE CORRIDOR PROJECT

CERTIFIED TRAFFIC REPORT

ODOT PID 89068 | KYTC PROJECT ITEM NO. 6-17
SEPTEMBER 19, 2024

HNTB

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  - Proposed factors including seasonal, COVID-19, expansion, and DHV factors
  - Traffic Count Plates
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    - 2019 AADT Targets and Balanced
    - Existing AM and PM Traffic Counts
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- Appendix C-6: Forecast Targets versus Balanced – Table
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Revision Record

Rev #	Date	Description	ODOT Approval	KYTC Approval	FHWA Approval
0	9/19/2024	Original submittal approved by ODOT, KYTC, and FHWA			
1	6/10/2025	Section 5.1 paragraph 2. The text was revised to clarify the development of traffic forecasts using the OKI travel demand model based on a comment received from KYTC during the review of the Interchange Modification Study report.			

1. INTRODUCTION

ODOT and KYTC approved certified traffic for the Brent Spence Bridge (BSB) project in May 2023 for three roadway scenarios:

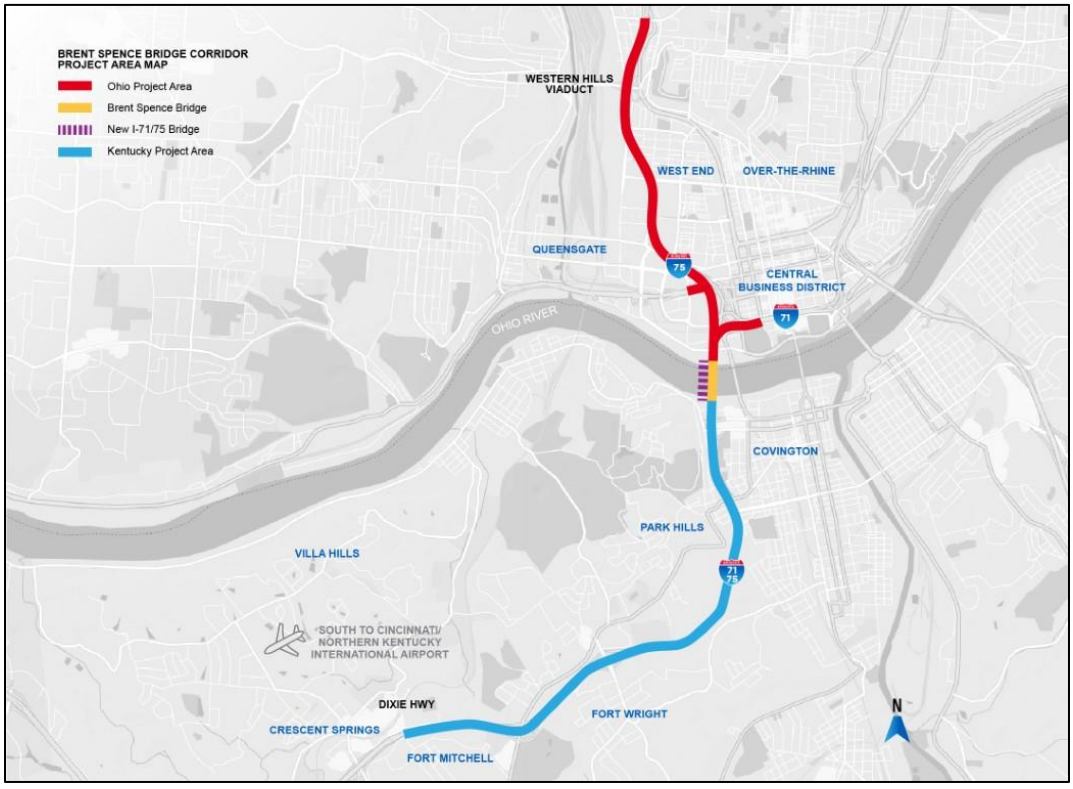
- 2029/2049 No Build
- 2029/2049 Selected Alternative I
- 2029/2049 Refined Alternative I (Concept I-W)

Since these forecasts, an Interchange Modification Study addendum was approved by FHWA in November 2023. Building upon the approved IMS, with preferred Refined Alternative I (Concept I-W), the BSB design-build team (DBT) has recommended design innovations. The alternative that enhances the approved IMS design is called Build Innovations in this report.

The forecasting methodology for Build Innovations follows the approved procedures outlined in the May 2023 certified traffic report, also documented in this report.

The forecasting limits for Build Innovations are unchanged from the other alternatives except for additional intersections in Covington along 3rd, 4th, and 5th Street to capture the impact of the 5th Street innovations. The forecast limits are outlined in **Figure 1**.

Figure 1: Traffic Forecast Study Area



2. PROJECT DESCRIPTION

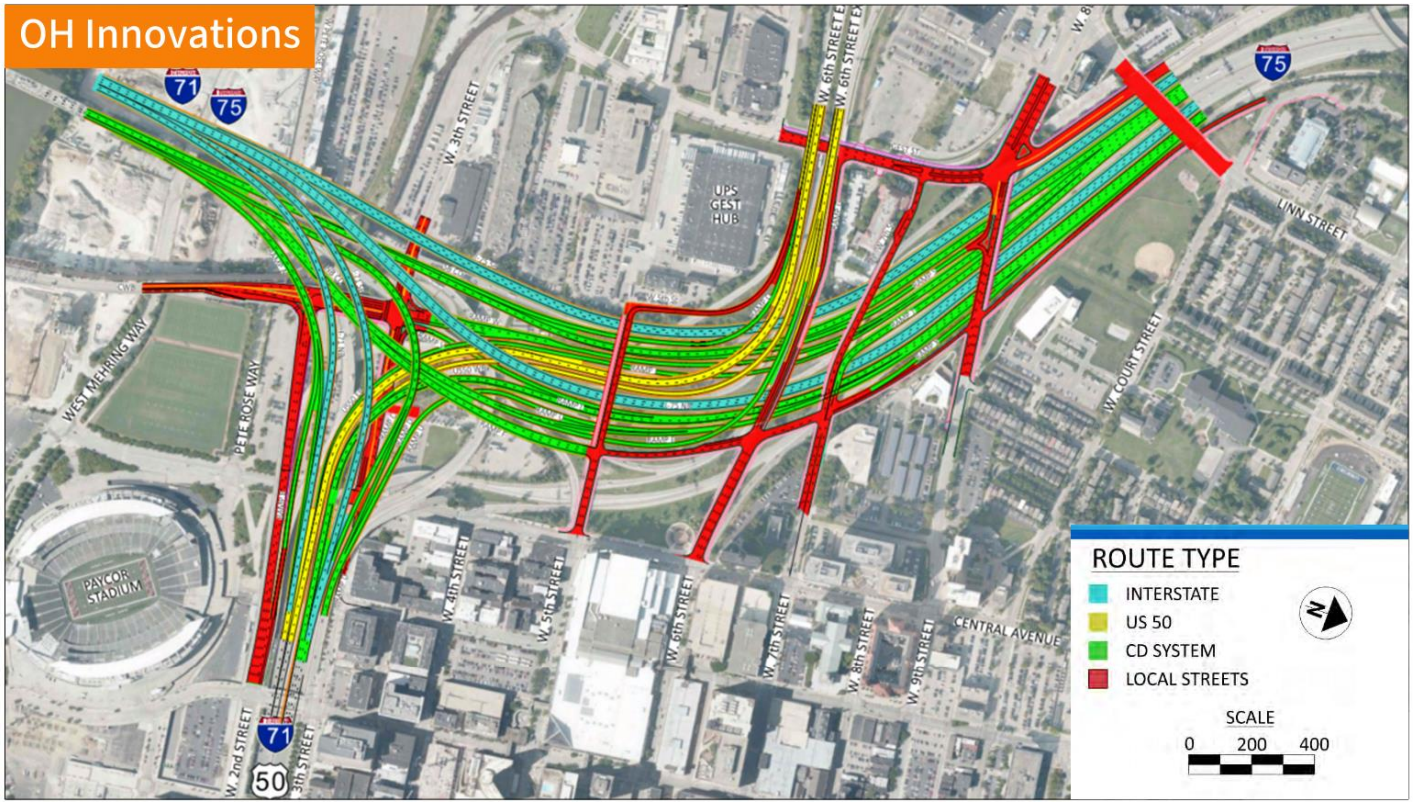
The purpose of the traffic forecasts is to support the Brent Spence Bridge IMS addendum for the Build Innovations alternative. In 2023, traffic forecasts were approved for an opening year 2029 and horizon year 2049 for a No Build, Selected Alternative I, and Refined Alternative I (Concept I-W). Refined Alternative I (Concept I-W) is the preferred alternative in the 2023 approved IMS. The forecasts for Build Innovations will have the same opening and horizon year and follow forecast procedures consistent with the traffic forecasts completed in 2023.

2.1 Build Innovations

A lane diagram of the Build Innovations alternative is provided in **Appendix C-1**. Figures of the design innovations are shown below. The Ohio innovations include:

1) The southbound I-71/75 roadway reconfiguration that removes the Western Avenue ramp to southbound I-75, among other roadway and safety improvements.
2) Combination of 2nd and 3rd Street connections.
3) The US-50 roadway consolidation removes the ramp from the westbound US-50 to Gest Street.
4) The Realization of the Street Grid Concept adds new intersections along 5th, 6th, 7th, and 9th Streets.

Figure 2: Ohio Innovations



The Kentucky innovations include:

1) Vertical profile optimization that results in the closure of 5th Street under I-71/I-75.
2) Pike Street access optimization that eliminates direct interstate access at 9th Street and maintains existing access at Pike Street.
3) Hillside cut alignment shift, which does not impact roadway access.

Figure 3: Kentucky Innovation 1

Figure 4: Kentucky Innovation 2

Figure 5: Kentucky Innovation 3

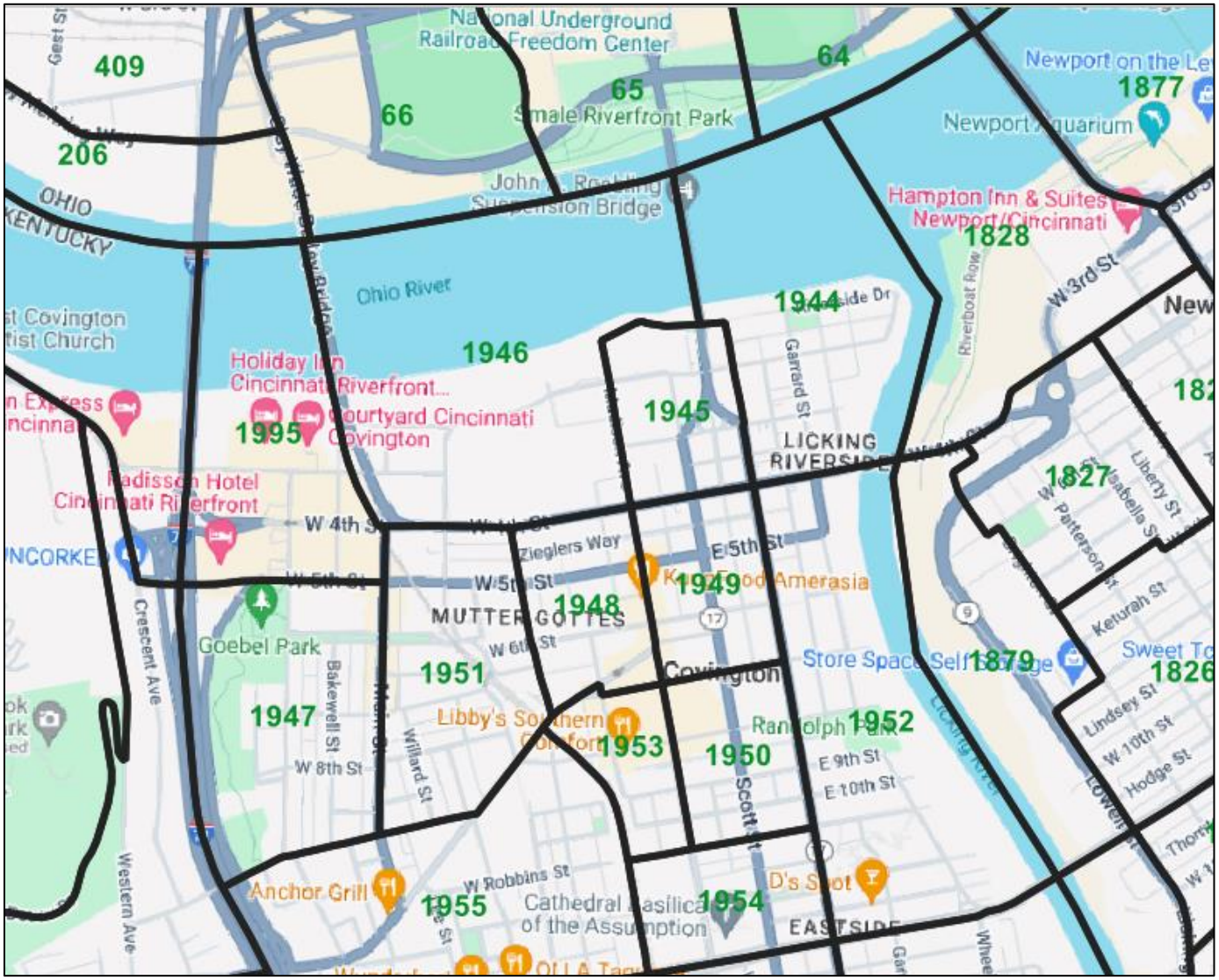
2.2 Local Projects

The Build Innovations forecast accounts for adjacent projects to the corridor limits. These include:

- Clay Wade Bailey with one lane in each direction
    - Included in OKI model for Build Innovations
- Elm Street closed between 5th and 6th Street due to the convention center's expansion.
    - Included in OKI model for Build Innovations
- IRS site development in Covington
    - The site plan is being finalized, with a Traffic Impact Analysis (TIA) being completed by 143Engineers. A draft traffic methodology report was provided to the BSB project team and considered as part of the forecasts. However, because the TIA forecasts were still in development, the BSB forecasts along Johnson Street will not be the same as those produced for the TIA.
    - The OKI model used for the forecasts includes development for this site with total (inbound and outbound) daily traffic demand for TAZ 1946 (as shown in **Figure 6**) of 20,785 (2020), 20,281 (2030), and 20,625 (2050). The 2020 traffic demand includes the IRS site, with the 2030 and 2050 demand assuming a development with traffic demand of similar magnitude to the IRS building.
    - As noted in the Covington Traffic Count memorandum (**Appendix B-1**), the 2019 balanced volumes on 4th and 5th Street include traffic demand from the IRS site.

- Forecasts are developed for intersections at 3rd Street and Johnson Street, including access to the IRS site. In conjunction with draft information from 143Engineers, OKI model results are used to forecast turn volumes at these intersections. Ultimately, the final traffic report from 143Engineers will be used to assess roadway improvements for 3rd and 4th Street intersections adjacent to the site. The level of detail included in the OKI model is adequate for assessing the traffic demand for the BSB project limits.

Figure 6: OKI Traffic Analysis Zones – Covington



3. FORECAST PARAMETERS

The forecast limits include the I-71/75 mainline and ramps between Buttermilk Pike and Hopple Street. The weave forecast is provided for I-75 NB between the Western Hills Viaduct (WHV) Interchange and Hopple Street Interchange. Other traffic weaves are evaluated with the origin-destination analysis described in **Section 6.6**. The study limits include 72 intersections, including Kentucky (**Table 1**) and Ohio (**Table 2**).

Table 1: Kentucky Intersections

Dixie Hwy @ I-71/I-75 NB	12th St @ I-71/ I-75 SB	Main St @ 5th St
Dixie Hwy @ I-71/I-75 SB	Pike St @ I-71/I-75 NB	Main St @ 4th St
Kyles Ln @ I-71/I-75 NB	Pike St @ I-71/I-75 SB	Philadelphia St @ 4th St
Kyles Ln @ I-71/I-75 SB	Philadelphia St @ 9th St	Crescent Ave @ 4th St
Kyles Ln @ US-25	Philadelphia St @ 5th St	9th St @ Simon Kenton Way
12th St @ I-71/I-75 NB	Pike St @ Main St	Crescent Ave @ 3rd St
Philadelphia St @ 3rd St	Bakewell St @ 4th St	Johnson St @ 3rd St
Johnson St @ 4th St	Johnson St @ 5th St	Bakewell St @ 5th St

Table 2: Ohio Intersections

9th St @ Central Ave	9th St @ Mound St	Central Pkwy @ Linn St
7th St @ Central Ave	8th St @ Linn St	Harrison Ave @ Spring Grove Ave
6th St @ Central Ave	Court St @ Linn St	Harrison Ave @ Winchell Ave
5th St @ Central Ave	Gest St @ Freeman Ave	Harrison Ave @ Patterson St
4th St @ Central Ave	Gest St @ Western Ave	Colerain Ave @ Harrison Ave
3rd St @ Central Ave	Gest St @ 7th St	Central Ave @ Brighton Pl
2nd St @ Elm St	Ezzard Charles @ Winchell Ave	Brighton Pl @ Central Pkwy
3rd St @ Elm St	Ezzard Charles @ Western Ave	Central Pkwy @ WHV
4th St @ Elm St	Ezzard Charles @ Linn St	Gest St & 8th St
3rd St @ Plum St	Liberty St @ Winchell Ave	WHV @ I-75 NB ramp
4th St @ Plum St	Liberty St @ Western Ave	Findlay St @ Dalton Ave
3rd St @ Race St	Findlay St @ Winchell Ave	Bank St. @ Dalton Ave

6th St WB @ Linn St	Findlay St @ Western Ave	NB Local & 5th Street
6th St EB @ Linn St	6th St @ Gest St	NB Local & 6th Street
3rd St @ US-42/US-127	Bank St. @ Winchell Ave	NB Local & 7th Street
2nd St @ CW Bailey Bridge	Bank St. @ Linn St	NB Local & 9th Street

The forecast years include an opening year of 2029 and a design year of 2049. The certified traffic plates include AADT, AM DHV, and PM DHV for an opening year and design year for Build Innovations. The traffic plates also compile the design-hour truck percentage (TD) and 24-hour truck percentage (T24). The truck factors reflect the percentages obtained with the base-year traffic counts and correlate to the build geometry.

4. OTHER STUDIES

The BSB IMS Addendum traffic forecasts were approved in May 2023. These updated forecasts adhere to the methodology used for that forecast. Other certified traffic forecasts in the study limits include the 2012 IMS and the ODOT study of I-75 between Linn Street and Hopple Street Interchange, which includes the WHV Interchange (PID 114161 and PID 113361). These certified traffic forecasts preceded the IMS addendum forecasts and were not reviewed for this forecast update.

4.1 OKI Recommended Projects

OKI published the metropolitan planning region's 2023-2027 Transportation Improvement Plan (TIP) and 2050 Long Range Transportation Plan (LRTP). A part of this plan surrounding the BSB corridor is shown in **Figure 7**. The TIP projects are displayed with green lines, and the LRTP projects are blue. The TIP includes the BSB project limits and a few adjacent improvement projects, including:

A) I-74/I-75 Roadway Widening

B) I-75 Roadway Widening

C) Arterial Improvements: Scott Street/Greenup Street (KY 17) one-way couplet to two-way street and upgrade Madison and Pike Streets

Notable projects in the LRTP include:

D) Buttermilk Interchange Reconstruction

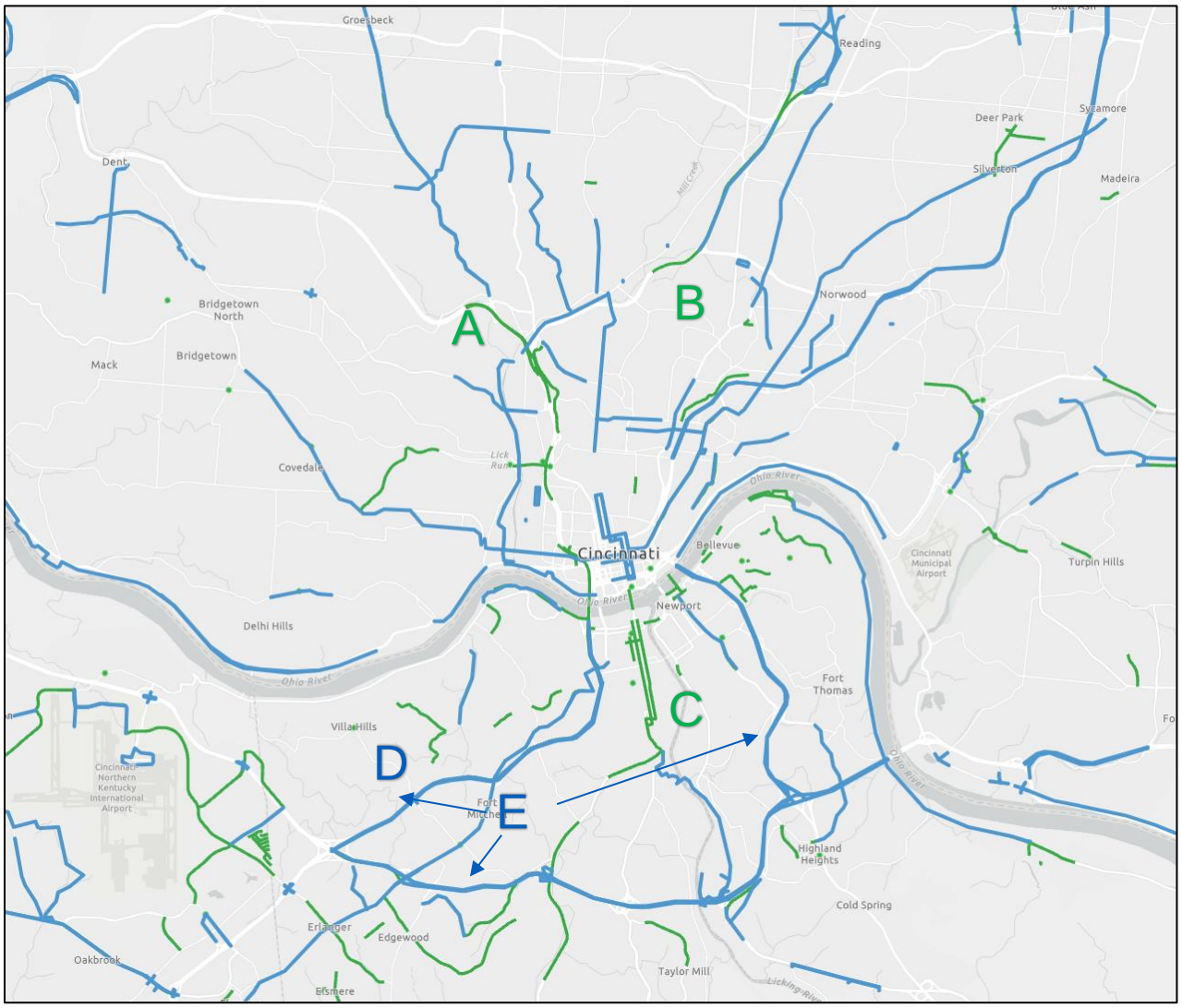
E) Transportation Systems Management and Operations (TSMO) Smart Lane (multiple corridors)

   a. I-71/I-75

   b. I-275

   c. I-471

Figure 7: OKI Recommended Projects



Source: https://2050update.oki.org/recommended-projects/

5. DATA SOURCES

5.1 Summary of Data Sources

No new traffic counts were obtained for this BSB-certified traffic report, except for the 3rd, 4th, and 5th Street corridors in Covington, with project counts taken in 2023 and 2024 and Streetlight volume estimates obtained for 2019. Details on all the traffic counts used for project forecasts are summarized in the count evaluation memorandum found in **Appendix B-1**. The details on the new intersections in Covington are outlined in a brief memorandum attached after the count evaluation memorandum. In general, the project uses traffic counts

collected between 2017 and 2022. The traffic counts were adjusted and balanced to a 2019 (pre COVID-19) condition. Existing AADTs were obtained from KYTC, ODOT, and OKI.

The study area land use assumptions rely on the OKI travel demand model. The project uses the OKI Model of Record (MOR) (as available in 2023), which has a calibration year of 2015 and has been updated by OKI to approximate 2020. OKI noted that they had made numerous updates from the 2015 model validation to 2020 for existing and future year networks. OKI is using 2020 as the region's base year for traffic analysis. The OKI TDM with a 2020 base year was used for the forecast completed in 2023 and for the Build Innovations forecasts completed in 2024. The OKI project level calibration is unchanged with the forecast update for the Build Innovations. The OKI model calibration process includes refining traffic analysis zones and reporting several validation measures. The validation results do not achieve all ODOT criteria; however, the forecast post-processing procedures account for the limitations. The details on the OKI model network updates and validation checks are summarized in **Appendix B-2**.

5.2 Existing Traffic Volume

The existing traffic volumes represent the year 2019. The balanced AADT and unbalanced peak-hour traffic counts are in **Appendix B-1**. The count evaluation memorandum details the methodology for adjusting the traffic counts to 2019 AADT. This includes discussing seasonal adjustment factors, expansion factors for turning movement counts, procedures for identifying count outliers, and an overview of the project design hour volume development factors.

6. DESIGN TRAFFIC VOLUMES

The design traffic volumes are developed using the NCHRP 255/765 forecasting approach with 2019 traffic counts, 2020 existing travel demand model assignments, and assignments from the 2030/2050 travel demand models for Build Innovations. ODOT's adjuster spreadsheets are used to calculate forecast targets. Note that the travel demand model years are in 5-year increments. The differences between model year and forecast year are accounted for using linear interpolation within the ODOT adjuster spreadsheets. The smoothing and balancing of the traffic volumes are completed outside the adjuster spreadsheet using a network-based analysis to minimize the difference between the balanced volumes and the target volumes. This balancing process also accounts for a target minimum, ensuring a non-negative target growth rate from 2019 to 2029 and 2029 to 2049. The non-negative growth rate check does not apply for growth between 2019 and 2029 for locations directly impacted by roadway access changes.

The key factors and constraints applied in the adjuster spreadsheets include the design hour factor for AM and PM counts (1.10 for freeway ramps and 1.15 for arterials). This factor is used globally for all ramp and arterial count locations. It is standardized for this project based on the review of the 2019 ODOT peak hour to design hour factors for urban interstates and urban arterials. Additional details are provided in **Appendix B-1** Count Evaluation Memorandum. The freeway mainline peak hour counts are adjusted using a proxy K-factor method. The proxy K-Factor method seeks to have mainline volumes consistent with the observed 30th highest hour K and D factors. The proxy K-method is applied at the BSB and I-71/I-75 external study limits, which include I-

71/I-75 south of Dixie Hwy, I-71/I-75 north of WHV, and I-71 east of I-75/I-75 system interchange. The resultant design hour factors for these mainline locations vary by site and are between 1.11 and 1.19.

6.1 Intersection Forecasting Process and Assumptions

The adjuster spreadsheet is set up for every intersection in the project corridor. The NCHRP255_link, 24_turns, PM_turns, and AM_Turns sheets are populated within the spreadsheet. The methodology and assumptions for each of the four sheets are listed below. The forecasts are first developed for total vehicles, then truck factors are derived as described in **Section 6.4.**

NCHRP255_link

This sheet holds the daily link forecasting data, which includes 2019 balanced AADT traffic counts, 2020 existing daily model assignment, 2030 daily model assignment, and 2050 daily model assignment. The growth rates are calculated using the NCHRP 255/765 process prescribed by ODOT's forecasting manual.

24_turns

The growth rates calculated from NCHRP255_link sheets are carried to the 24_turns sheet. Existing 2019 AADT by-turn movements are entered into the sheets. The total vehicle volumes are entered in the "pc" field. The truck factors are calculated outside the adjuster spreadsheets. Turn model volumes were entered to calculate turn-specific growth rates. The resultant 2029 and 2049 daily volumes are used as forecast targets in the balancing and smoothing methodology outside the adjuster spreadsheet. Volumes are not carried back into the spreadsheet after balancing; a summary table is provided to compare the target volumes for each turning movement and the resultant balanced volumes as a reasonableness check (**Appendix C-6**).

PM_turns

The growth rates calculated from NCHRP255_link sheets are carried to the PM_turns sheet. The balanced peak hour turn counts are entered into the sheets for total vehicles. The intersection adjuster spreadsheet uses a peak hour to design hour factor of 1.10 for freeway ramps and 1.15 for arterials, as identified from ODOT's 2019 tables and presented in the count evaluation memo. The DHV factor is entered directly into column N of the spreadsheet. The rest of the forecasting process follows the procedure outlined for the daily turn forecasts.

AM_turns

AM_turns sheet follows the same procedure as the PM, except the DHV factors are carried over from the PM_turns sheet.

6.2 Ramp and Mainline Forecasts

The ramp and mainline forecasts are also calculated using the adjuster spreadsheet, with the same DHV methodology described for the intersections. The ramp and mainline forecast targets are combined with the intersection forecast targets in the balancing and smoothing. The balanced volume is not reported in the

adjuster spreadsheet. The total BSB span was forecasted by direction using the model assignments for all the bridge spans. The target volume for each span was calculated using proportions from the OKI travel demand model for AM, PM, and Daily.

The weave volume for NB I-75 between WHV and Hopple Street Interchange is computed using ODOT's weave analysis spreadsheets. The input and output data from this analysis are summarized in **Appendix C-7.** Streetlight O-D patterns were used to calculate the weave distributions. Other traffic weaves will be evaluated using the origin-destination forecasts used in the TransModeler analysis.

6.3 Forecast Balancing and Smoothing

All the forecast targets developed with the adjuster spreadsheets are compiled in one database to complete a network-wide balancing procedure. The target forecasts were balanced to have a closed system of traffic volumes where the network "ins" equals the network "outs." The traffic balancing used a combination of automated optimization routines and manual inspection. The balancing optimization routine is similar to ODOT's balancing principle of the "split the difference" method, where the forecast targets are balanced to have values that are the best fit between all of the data points. The algorithm for the balancing optimization is built with the R scripting language. It employs the principles of entropy maximization, where the best solution is derived through random and iterative factoring of the forecast targets. Each factoring step optimizes the solution for a given forecast target location. The final solution is derived using a method of successive averages, where each location receives the same number of factoring iterations, which means an equal priority in the balancing process. The one exception to the equal weight rule is at the Ohio River crossing (Brent Spence Bridge and companion bridge), where this location serves as a control point for the study limit, and the balanced volume equals the target volume.

The result from the balancing process is then manually reviewed and adjusted to best conform with forecast targets, non-negative growth rates, and desired K-factors.

A comparison of the forecast target (as found in the adjuster spreadsheet) and the final balanced volumes are summarized in table form in **Appendix C-6**. The unsmoothed traffic forecasts can be viewed in diagram form in the adjuster spreadsheets found within the project files.

6.4 Design Truck Factors

Design truck factors are developed for Build Innovations. The truck factors are based on existing turn movement and short-term link counts. The build alternatives correlate traffic counts to compatible intersections, ramps, and mainline segments. A unique truck factor is derived for all project road segments by using a similar process to balance the traffic forecasts, where a balanced truck volume is derived that best matches the truck percentage targets. The BSB truck percentages are based on a 2017 classification count collected by KYTC, which indicates the following truck percentages for the bridge:

- NB I-71/75
    - AM Peak: 10%
    - PM Peak 12%
    - Daily: 17%
- SB I-71/75
    - AM Peak: 11%
    - PM Peak: 9%
    - Daily: 18%

The percentages across each bridge span are derived using the truck percentages at service ramps, intersections, and other mainline traffic counts. For instance, the BSB CD bridge span's truck percentages are influenced by observed truck volume on the ramps that will utilize the bridge in the build alternatives based on the OKI TDM. This leads to a lower truck percentage on the C-D bridge than the limited access I-71 and I-75 bridges.

6.5 Certified Traffic Plates

Certified traffic plates are developed for Build Innovations. The traffic plates are in **Appendix A** and are organized in the following sub-appendices:

- Appendix A-1: Daily Build Innovations (2029 & 2049)
- Appendix A-2: AM DHV Build Innovations (2029 & 2049)
- Appendix A-3: PM DHV Build Innovations (2029 & 2049)
- Appendix A-4: Truck Factors – Build Innovations (AM TD/PM TD/T24)

6.6 TransModeler Origin-Destination Matrices

TransModeler analysis is used by the BSB Corridor project to measure the traffic operations of the alternatives. As part of the analysis, origin-destination (O-D) matrices are developed for the peak periods that encapsulate the certified traffic forecasts. This work was previously completed for the No Build, Selected Alternative I, and Refined Alternative I (Concept I-W). The same procedures will be repeated for Build Innovations, and the O-Ds will be developed after the approval of the certified traffic. The methodology for the Origin-Destination Matrix

Estimation (ODME) is described below. Furthermore, critical traffic weave movements within the corridor are forecasted as part of this O-D development process.

Certified Traffic forecasts are developed for 2049 AM and PM design hour volumes. The Existing calibrated TransModeler model represents 6-10 AM and 2-7 PM peak periods. To ensure the models are consistent with the certified design hour volumes and the calibrated 2019 model, the project team created proportioning factors to convert the certified traffic into 15-minute bins that blend data from the calibrated 2019 models and the certified traffic forecasts. This procedure results in 15-minute origin-destination matrices in three vehicle classifications (autos, single-unit trucks, and multi-unit trucks) used as inputs for the TransModeler analysis. The process follows these three steps to derive O-D matrices for each of the 2049 model scenarios:

1) ODME was completed for the 1-hour AM and PM design hour traffic. The ODME uses the OKI travel demand model as a pattern O-D matrix. The outcome of this step is a 1-hour O-D matrix (auto and truck classifications) for the AM peak and one for the PM peak that replicates the forecasted traffic volumes at the roadway link and turn movements. The peak hours are 7:30-8:30 AM and 4:30-5:30 PM.
2) The 1-hour matrices are then proportioned into 15-minute loading matrices based on the traffic loading proportions from the Existing calibrated TransModeler models. The 15-minute proportions are shown in **Figure 8** (AM) and **Figure 9** (PM).
3) The truck matrices are then divided into single-unit and multi-unit classes using origin and destination proportions from the Existing calibrated TransModeler network. The final single-unit and multi-unit truck matrices are derived using Fratar Factoring.

The result of the ODME is TransModeler traffic inputs consistent with the certified traffic volumes, OKI travel demand model, and temporal distributions from the Existing calibrated TransModeler model.

Figure 8: AM Period O-D Proportions

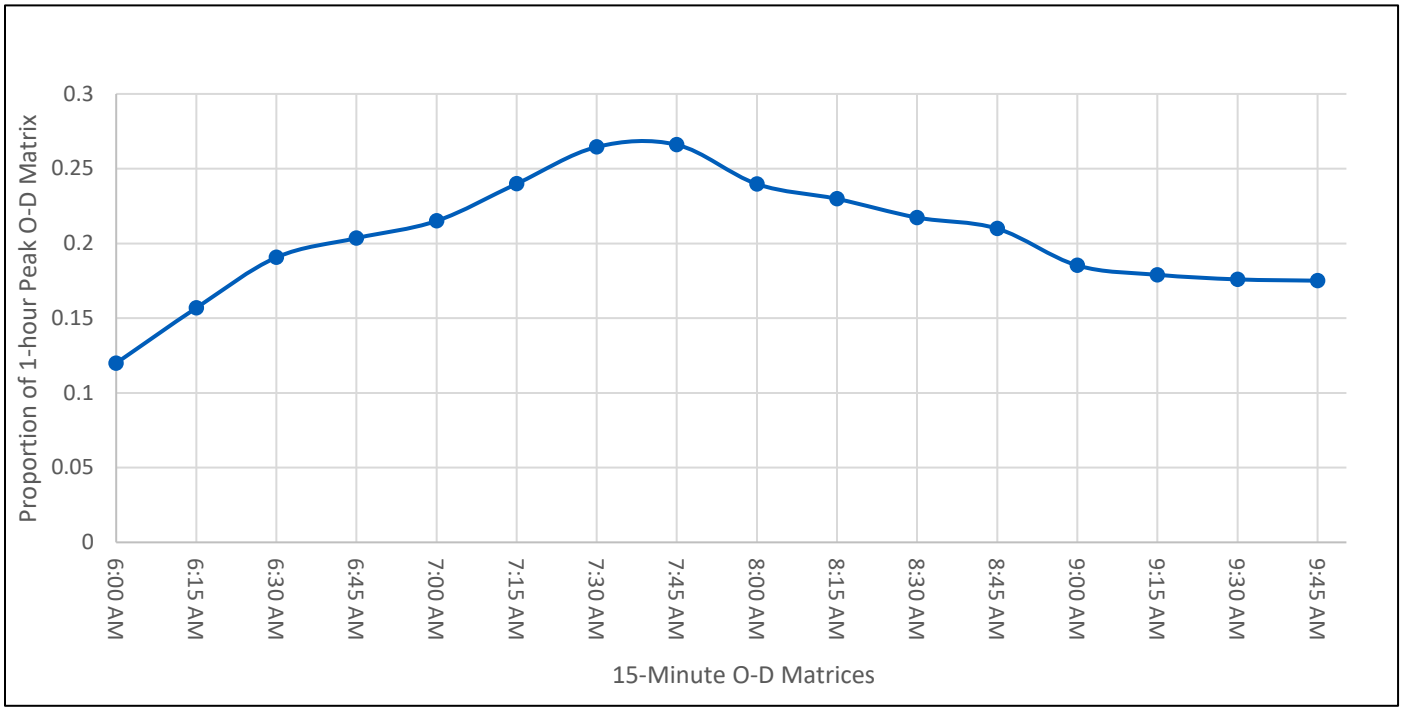
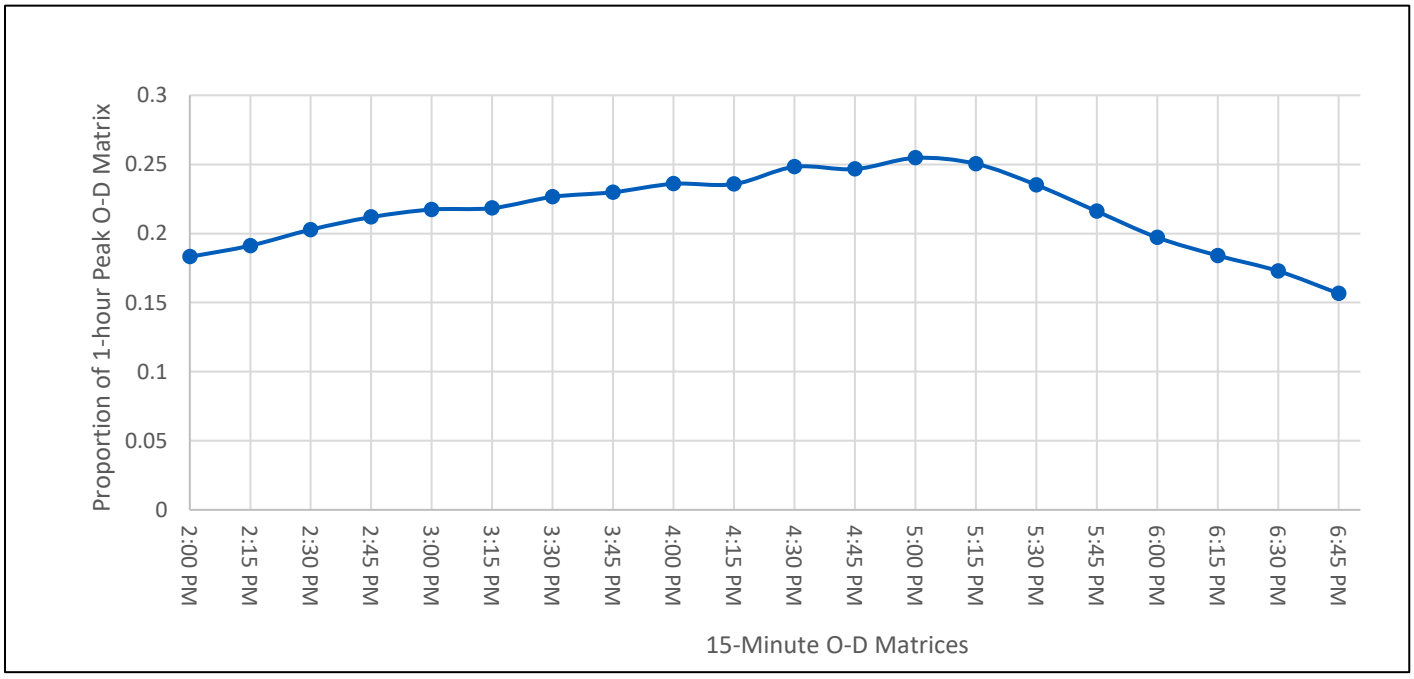


Figure 9: PM Period O-D Proportions



7. IMS FORECAST COMPARISON

A traffic forecast comparison is included for the No Build, Refined Alternative I (Concept I-W), and Build Innovations. Overall, the 2049 Refined Alternative I (Concept I-W) forecasts are similar to the Build Innovation forecasts, except at locations impacted by Build Innovation's access modifications. A list of the innovations and the impacts on the traffic forecasts are discussed below:

Kentucky Innovations

Vertical profile optimization

This innovation closes 5th Street between Crescent Avenue and Philadelphia Street. The closure reroutes traffic to 3rd Street and Crescent Avenue.

Pike Street Access Optimization

This innovation removes I-71/I-75 SB access to 9th Street at the Bullock Street intersection. The NB frontage road to NB CD road access has also been moved south from 9th Street to Pike Street. These changes result in local traffic shifts caused by access modifications.

Hillside Cut Alignment Shift

This innovation has no impact on traffic forecasts.

Ohio Innovations

Southbound Roadway Reconfiguration

I-71 Southbound is reconfigured, and the Western Avenue ramp has been removed to southbound I-75. Alternative routes to this ramp include the new proposed 9th Street entrance ramp and the existing Freeman Avenue Interchange. This is a low-volume movement, resulting in minor traffic redistribution.

Combination of 2nd and 3rd Street Connections

The SB I-75 2nd Street ramp is removed, and traffic is rerouted through upgraded at-grade 2nd and 3rd Street intersections. The additional delay at these intersections is anticipated to reroute some traffic to the upstream exit ramp at 7th Street.

US-50 Roadway Consolidation

The ramp from westbound US-50 to Gest Street has been removed; the primary traffic reroute is through the existing Linn Street exit ramp.

Realization of Street Grid Concept

This innovation includes new intersections along Gest Street and a new northbound road between 5th Street and 9th Street. The new connections result in several local routing changes that impact traffic demand on roads between 5th and 9th Street.

A screenline comparison of Brent Spence and Clay Wade Bailey bridges is shown in **Table 3** (Daily), **Table 4** (AM DHV), and **Table 5** (PM DHV). One notable difference between the No Build and Build alternatives is the Clay Wade Bailey Bridge, which has a higher traffic demand in the No Build due to the absence of the 4th Street entrance ramp. Traffic traveling between Covington and Cincinnati prefers the Clay Wade Bailey over using the turnaround at Pike Street.

Table 3: Daily Traffic Forecast Comparison – Ohio River Screenline

Facility			Daily		
Route	**Bridge**	**Direction**	**2049 No Build**	**2049 Refined Alt I (I-W)**	**2049 Build Innovations**
I-71/I-75	Brent Spence	NB I-71	86,900	57,550	58,050
		NB I-75			
		NB I-71/75 CD		38,750	38,000
		SB I-71	96,050	60,250	61,350
		SB I-75			
		SB I-71/75 CD		40,500	39,350
US-25/US-42/US-127	Clay Wade Bailey	NB	17,900	10,700	11,450
		SB	8,650	7,600	7,950
Screenline		NB	*104,800*	*108,400*	*107,500*
		SB	*104,700*	*108,150*	*108,650*
		Total	***209,500***	***215,350***	***216,150***

Table 4: AM Peak Hour Traffic Forecast Comparison – Ohio River Screenline

Facility			AM Peak Hour		
Route	**Bridge**	**Direction**	**2049 No Build**	**2049 Refined Alt I (I-W)**	**2049 Build Innovations**
I-71/I-75	Brent Spence	NB I-71	8,000	5,120	5,180
		NB I-75			
		NB I-71/75 CD		3,840	3,760
		SB I-71	6,460	4,230	4,290
		SB I-75			
		SB I-71/75 CD		2,530	2,440
US-25/US-42/US-127	Clay Wade Bailey	NB	2,320	1,300	1,520
		SB	410	350	460
Screenline		NB	*10,320*	*10,260*	*10,460*
		SB	*6,870*	*7,110*	*7,190*
		Total	***17,190***	***17,370***	***17,650***

Table 5: PM Peak Hour Traffic Forecast Comparison – Ohio River Screenline

Facility			PM Peak Hour		
Route	**Bridge**	**Direction**	**2049 No Build**	**2049 Refined Alt I (I-W)**	**2049 Build Innovations**
I-71/I-75	Brent Spence	NB I-71	6,630	4,530	4,530
		NB I-75			
		NB I-71/75 CD		2,910	2,890
		SB I-71	8,450	4,710	4,770
		SB I-75			
		SB I-71/75 CD		4,130	4,040
US-25/US-42/US-127	Clay Wade Bailey	NB	1,320	910	1,000
		SB	1,350	1,080	1,330
Screenline		NB	*7,950*	*8,350*	*8,420*
		SB	*9,800*	*9,920*	*10,140*
		Total	**17,750**	***18,270***	**18,560**

Daily volume comparisons for mainline and ramp locations are in **Table 6** (southbound I-71/75) and **Table 7** (northbound I-71/75). The main traffic forecast differences between Refined Alternative I (Concept I-W) and Build Innovations include:

- **SB Exit to 7th Street (Ohio):** traffic increases with the removal of direct ramp access to 2nd Street
- **SB Exit to 3rd Street/Clay Wade Bailey Bridge (Ohio)**: traffic increases with the removal of direct ramp access to 2nd Street
- **SB Entrance from 9th Street**: traffic increases due to additional ramp access from west of the I-75
- **SB Exit to 5th Street (Kentucky)**: traffic decreases due to removal of direct access to Crescent Avenue.
- **NB Exit to 5th Street/Central:** Traffic increases for this movement due to the additional access points the ramp serves.
- **NB Exit at Winchell/Ezzard Charles:** traffic increases due to access modification along 5th and 9th Street that enhances roadway connectivity to the exit ramp.
- **NB Exit ramp at Western Hills:** the Build Innovations OKI model was updated to restrict traffic from using this exit ramp and then turning right at the WHV loop ramp to Harrison Street.

Table 6: Traffic Forecast Comparison – SB I-71/75 Mainline and Ramps

Facility Name	No Build 2049 Daily	Refined Alt I (I-W) Daily 2049	Build Innovations Daily 2049
SB North of Western Hills Viaduct	97,050	96,500	95,750
SB Exit Ramp at Western Hills Viaduct	7,850	14,250	15,200
SB Entrance Ramp at Western Hills Viaduct	6,650	7,200	6,600
SB Mainline between Western Hills and Gest	95,850	89,450	87,150
SB Diverge to Gest	6,750	6,850	7,350
SB Entrance Ramp from Western Avenue	2,900	2,350	-
SB Exit to 7th Street	9,100	15,450	21,200
SB Exit to 5th Street/Central Avenue	4,150	–	-
SB Exit to 2nd	7,450	11,400	-
SB Exit to 3rd Street/Clay Wade Bailey Bridge	–	1,700	6,850
SB Entrance from 9th Street	6,700	6,400	11,800
SB Entrance from 6th Street	7,850	–	-
SB Entrance from 3rd Street	8,550	11,550	14,100
SB Exit to 5th St	8,800	7,850	5,500
SB Exit to Frontage	–	6,400	6,350
SB Mainline after Merge of BSB	96,050	86,500	88,850
SB Entrance from 12 St	8,100	12,250	11,650
SB Mainline north of Kyle	96,300	98,750	100,500
SB Exit to Kyle Ln	7,900	8,550	8,400
SB Entrance from Kyle Ln	5,500	5,150	4,900
SB Exit to Dixie Hwy	6,400	5,450	5,200
SB Entrance from Dixie Hwy	4,700	5,000	5,250
SB I-75 south of Dixie Hwy	92,200	94,900	97,050

Table 7: Traffic Forecast Comparison – NB I-71/75 Mainline and Ramps

Facility Name	No Build 2049 Daily	Refined Alt I (I-W) Daily 2049	Build Innovations Daily 2049
NB North of Western Hills Viaduct	99,500	98,850	97,150
NB Entrance Ramp at Western Hills	17,650	16,600	15,150
NB Exit ramp at Western Hills	8,750	11,050	8,300
NB Mainline btwn Ezzard Charles and WHV	90,600	93,300	90,300
NB Entrance from Gest	7,750	16,250	17,150
NB Exit at Winchell/Ezzard Charles	2,050	3,500	7,850
The ramp from 3rd St/Bailey Bridge to I-75 NB	–	3,050	5,500
NB Entrance from 4th St {3rd St Build Alts}	13,150	6,300	6,800
NB Exit to 6th Street	8,650	8,550	8,800
NB Exit to 5th St/Central	4,000	5,650	10,950
NB Exit to 2nd Street	5,400	5,600	5,400
NB Entrance from 4th St (Kentucky)	–	6,600	6,900
NB Entrance from Pike St/9th St to I-75/71	12,350	10,750	9,300
NB Exit to 12th St	6,900	7,050	6,050
NB I-75 North of Kyle Ln	88,300	92,100	94,150
NB Entrance from Kyle	7,650	8,300	8,250
NB Exit to Kyle	7,400	5,100	4,950
NB Entrance from Dixie Hwy	8,700	7,800	7,150
NB Exit to Dixie Hwy	5,650	4,500	4,100
NB I-75 south of Dixie Hwy	85,050	85,600	87,800

A comparison of forecasts along screenline locations of I-71 and I-75 are summarized in **Table 8.** This table compares the volumes on the freeway mainline, C-D, and frontage roads. The No Build does not have C-D roads in Kentucky, but it does have ramps running parallel to the freeway mainline in locations where C-D roads are located in the build alternatives. Therefore, as noted in the table below, a few ramps are included as C-D volumes for comparison.

Table 8: I-71 & I-75 Screenline Comparison

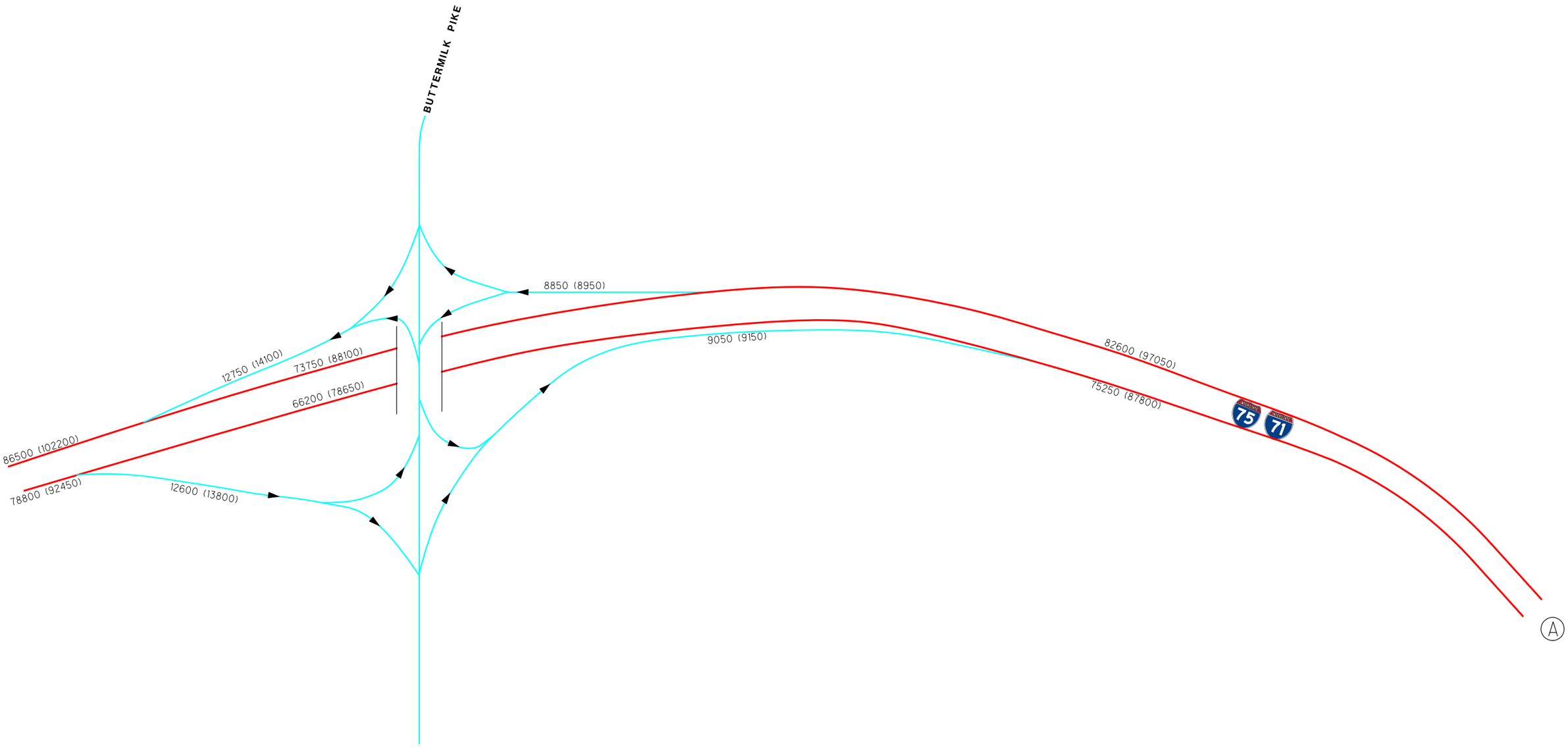
I-71 & I-75 Screenlines	No Build 2049 Daily	Refined Alt I (I-W) Daily 2049	Build Innovations Daily 2049
I-71/I-75 Between Dixie Hwy and Kyles Lane (Kentucky)	182,000	184,250	187,850
NB C-D Road	-	12,450	11,650
NB Mainline	88,100	76,450	79,200
SB Mainline	93,900	85,050	87,200
SB C-D Road	-	10,300	9,800
I-71/I-75 at 9th Street (Kentucky)	192,450	198,300	200,900
Simon Kenton Way (NB Frontage)	-	12,400	1,100
NB C-D Road	19,200[1]	27,500	39,350
NB Mainline	74,550	57,550	58,050
SB Mainline	80,750	60,250	61,350
SB C-D Road	7,450[2]	26,250	27,500
Bullock Street (SB Frontage)	10,500	14,350	13,550
I-71 east of Elm Street (Ohio)	169,400	181,200	175,300
3rd Street	18,100	22,650	25,200
SB Mainline	67,500	71,650	70,500
NB Mainline	62,950	68,200	66,550
2nd Street	20,850	18,700	13,050
I-75 north of 9th Street (Ohio)	154,150	165,500	162,800
NB C-D Road	38,200[3]	44,300	49,850
NB Mainline	37,850	36,250	31,150
SB Mainline	40,250	47,900	31,150
SB C-D Road	37,850[4]	37,050	48,650

1 - Includes braided ramps in place of C-D Road
2 - Includes entrance ramp in place of C-D Road
3 - Includes Exit Ramp to Winchell Avenue
4 - Includes 7th Street Exit Ramp

Appendix E-2:
Build Innovation Certified Traffic

NOTE

BUTTERMILK DDI CONFIGURATION IS NOT INCLUDED IN BRENT SPENCE BRIDGE PROJECT.

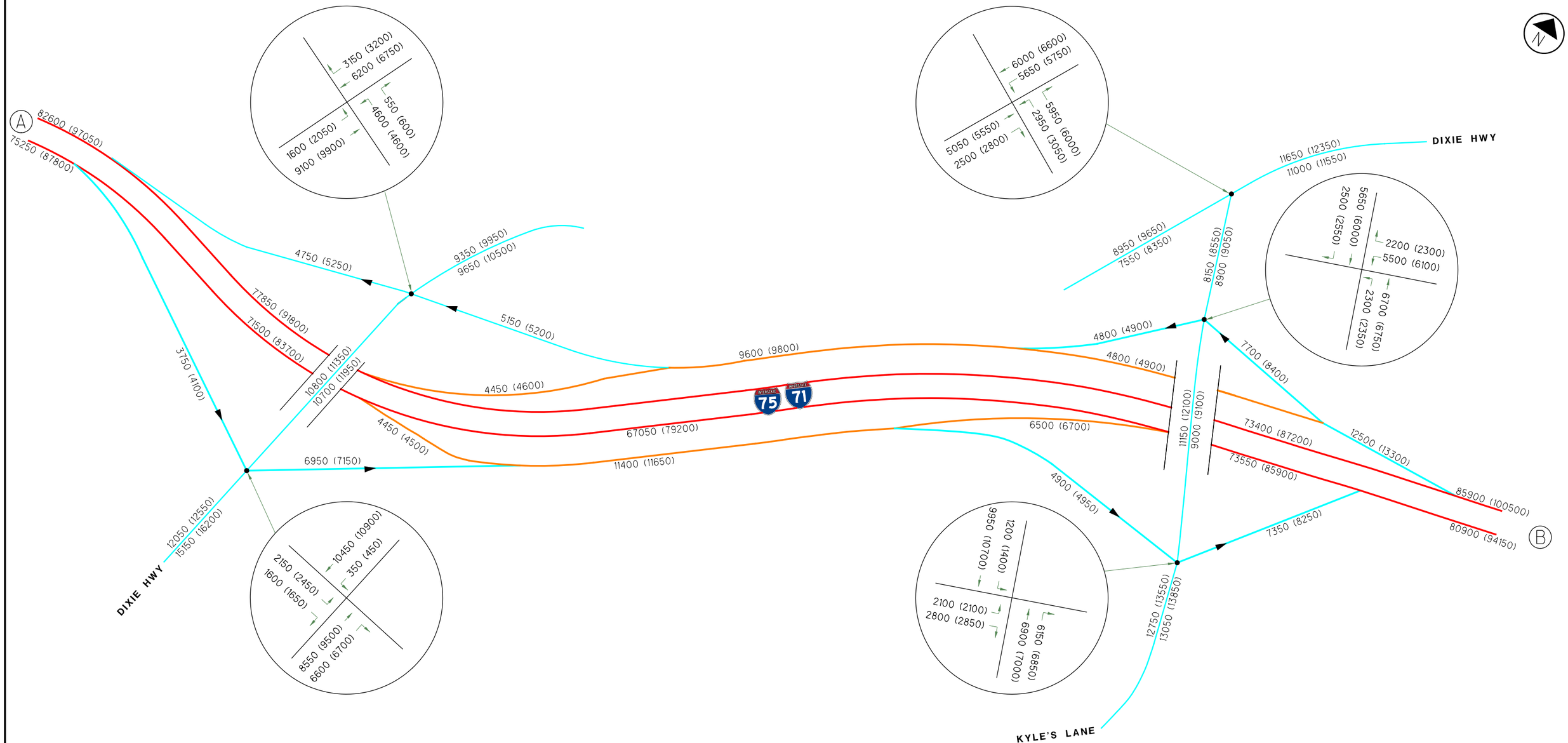


LEGEND

XXX (XXX) = 2029 AADT (2049 AADT)

I-71/I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE		
2029 & 2049 DAILY TRAFFIC FORECASTS		
PLATE 1 OF 10 (KY)		REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS
SEP 2024	NOT TO SCALE	
HNTB		



LEGEND

XXX (XXX) = 2029 AADT (2049 AADT)

I-71/I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

2029 & 2049 DAILY TRAFFIC FORECASTS

PLATE 2 OF 10 (KY)

REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB

INT. 1

750 (800)
8850 (9400)
1350 (1400)
2050 (2150)
2150 (2200)
3950 (4000)
950 (1000)

INT. 2

4500 (4550)
3350 (3400)
1800 (1850)
3500 (3550)
850 (950)
5350 (5750)
7650 (7900)

7750 (7900)
550 (600)
4550 (4900)
6900 (7050)
1500 (1600)
3500 (3600)
2450 (2500)

CRESCENT AVE.

700 (800)
400 (500)
2000 (2100)
4150 (4200)
1950 (2050)
4400 (4450)
4900 (5150)
4TH ST.

200 (250)
1800 (1850)
250 (300)
150 (200)
500 (550)
3900 (3900)

N

C

550 (650)
800 (900)
6850 (7200)
12950 (13550)
6100 (6350)
22800 (27500)
8050 (8500)
8300 (8500)
12TH ST.
350 (500)
2600 (3050)
9900 (10150)
BULLOCK ST.
9250 (9500)
5950 (6100)
28900 (33850)
IR-71/IR-75 SB LOWER LEVEL
52050 (61350)
IR-71/IR-75 NB UPPER LEVEL
50400 (58050)
LOCAL SB UPPER LEVEL 34150 (39350)
LOCAL NB LOWER LEVEL 32150 (38000)

100 (150)
6150 (6300)
1750 (1800)
3650 (3700)
850 (1250)
250 (350)
4050 (4100)

4300 (4450)
5400 (5500)
74850 (88850)
11050 (11650)
85900 (100500)
50400 (58050)
33450 (39350)
25450 (31100)
8000 (8250)
8950 (9350)
5250 (5500)
9300 (9600)
6700 (6900)

5150 (5200)
1100 (1150)
4200 (4250)
2200 (2300)
900 (950)
6650 (7050)
1950 (2000)

950 (1100)
8800 (9300)
1000 (1100)
750 (850)
850 (950)
1150 (1200)
1550 (1650)
500 (550)
9800 (10400)
24650 (30050)
80900 (94150)
30500 (36100)
5850 (6050)
7100 (7450)
SIMON KENTON WAY

300 (350)
500 (550)
200 (250)
150 (200)
650 (650)
350 (400)
500 (550)

PHILADELPHIA ST.
1400 (1550)
1650 (1800)
14200 (14850)
2000 (2100)
6400 (6550)
6250 (6350)
4150 (4300)
16000 (16500)

4950 (5000)
8450 (8950)
800 (900)
600 (650)
1400 (1450)
1450 (1550)
200 (250)

10050 (10650)
BAKEWELL ST.
9500 (10000)

100 (150)
100 (100)
200 (250)
100 (100)
850 (900)
9200 (9600)
1600 (1650)

500 (550)
4900 (4950)
100 (150)
2000 (2100)
3750 (3800)
4600 (4800)
4200 (4300)

8800 (9100)
8650 (8750)
PIKE ST.
5500 (5800)
6100 (6250)
3000 (3100)
3800 (3900)
MAIN ST.
9TH ST.
2900 (3150)
2700 (2800)

4600 (4750)
4650 (4750)
1600 (1650)
4050 (4300)
1450 (1500)
1150 (1350)
4350 (4450)

2900 (3000)
100 (100)
3500 (3550)
2600 (2700)
300 (350)
2600 (2800)

1150 (1200)
350 (400)
400 (450)
500 (550)

MAIN ST. 2800 (2950)
4900 (5000)
4200 (4350)
5300 (5400)
7850 (7950)
11150 (11450)
10950 (11600)
11650 (12150)
CLAY WADE BAILEY BRIDGE

11950 (12600)
13850 (14600)
5TH ST.
4TH ST.

INT. 1
INT. 2

A
B

LEGEND

XXX (XXX) = 2029 AADT (2049 AADT)

I-71/I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

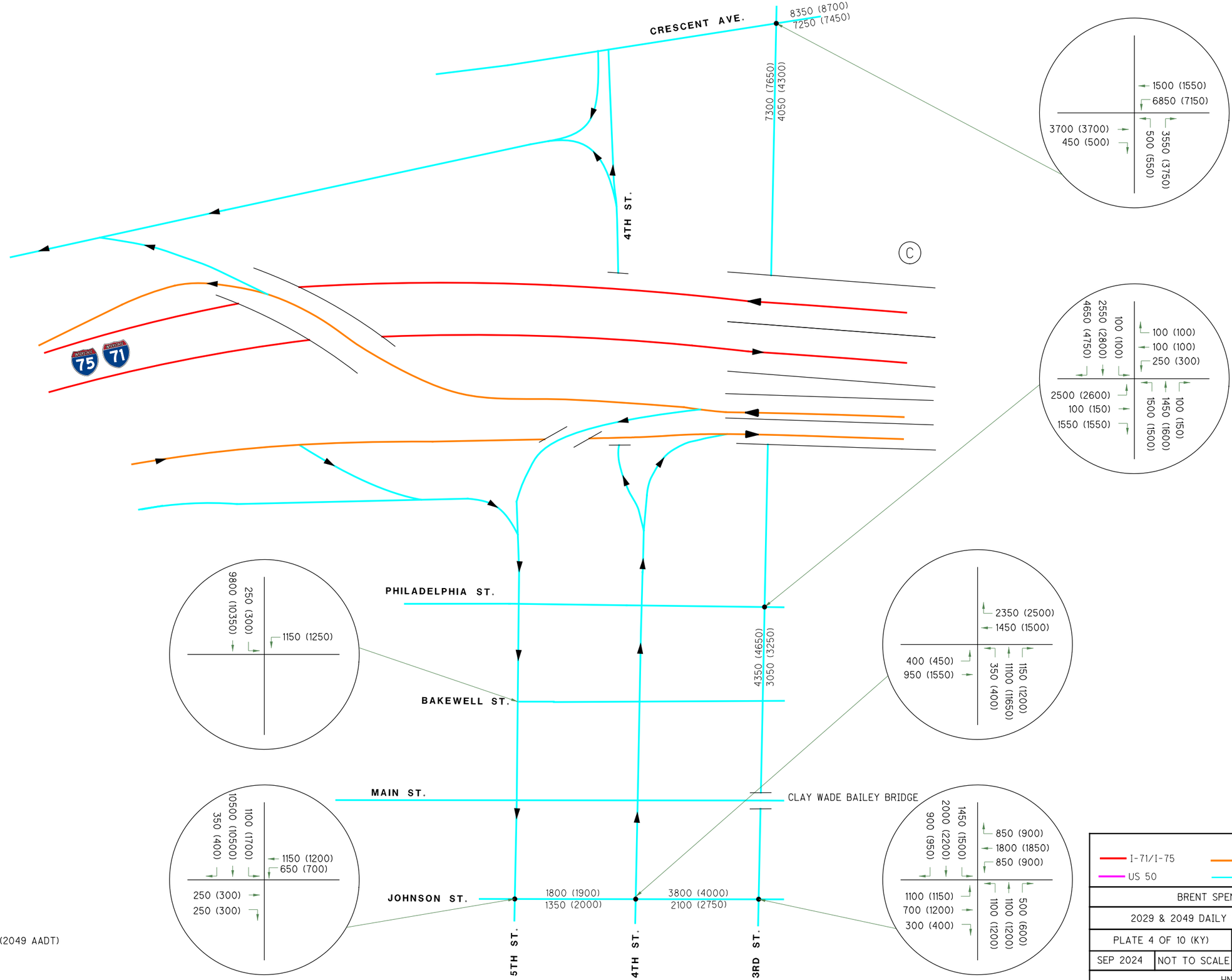
2029 & 2049 DAILY TRAFFIC FORECASTS

PLATE 3 OF 10 (KY)

REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB



SEE PLATE 3 FOR ADDITIONAL VALUES

LEGEND

XXX (XXX) = 2029 AADT (2049 AADT)

I-71/I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

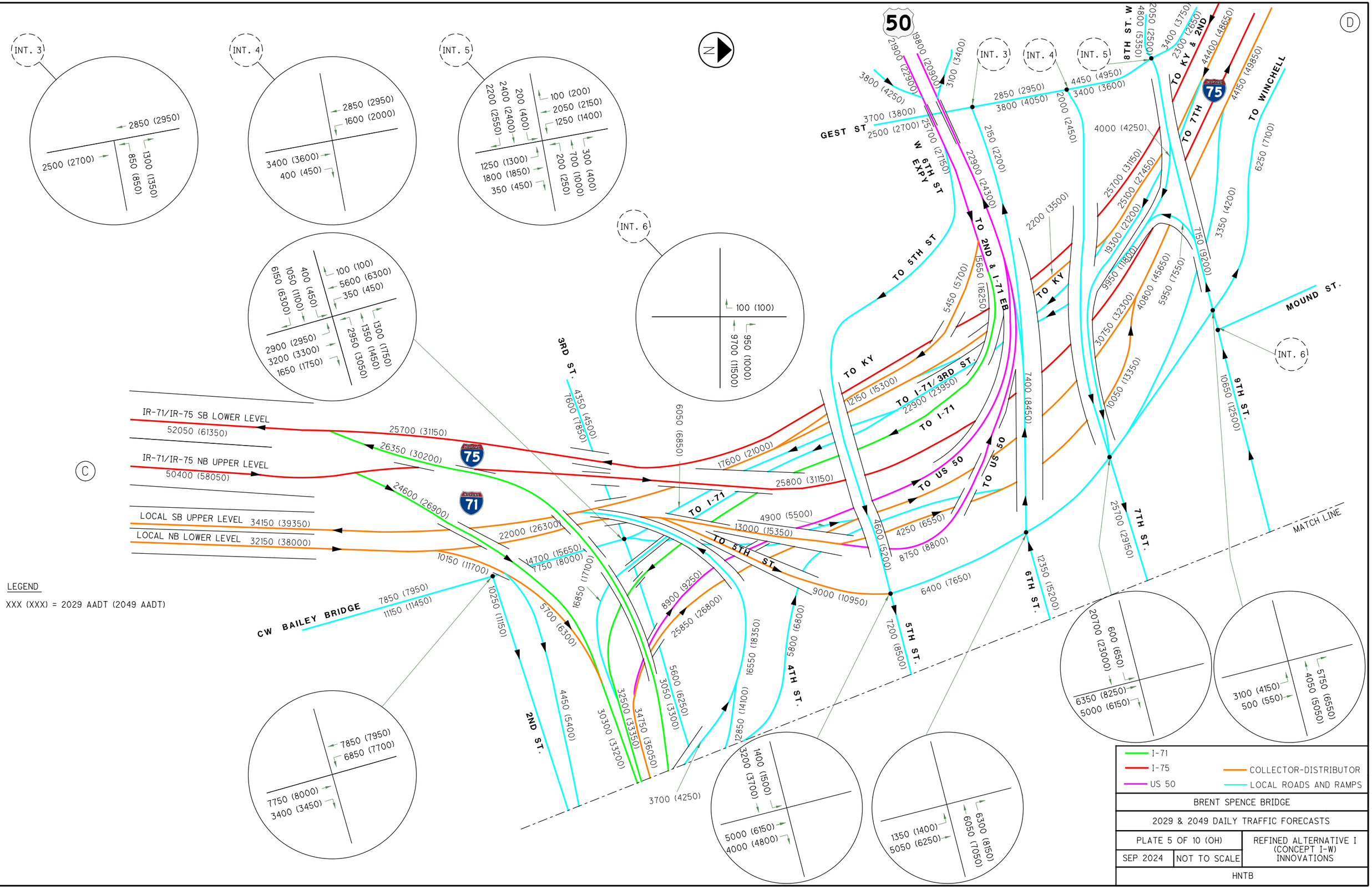
2029 & 2049 DAILY TRAFFIC FORECASTS

PLATE 4 OF 10 (KY)

REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB


INT. 3
2850 (2950)
2500 (2700)
850 (850)
1300 (1350)
INT. 4
2850 (2950)
1600 (2000)
3400 (3600)
400 (450)
INT. 5
100 (200)
2050 (2150)
1250 (1400)
2400 (2400)
2200 (2550)
200 (400)
1250 (1300)
1800 (1850)
350 (450)
200 (250)
700 (1000)
300 (400)
INT. 6
100 (100)
9700 (11500)
950 (1000)
N
50
INT. 3
INT. 4
INT. 5
8TH ST. W
TO KY & 2ND
TO 7TH
TO WINCHELL
GEST ST
W 6TH ST EXPY
TO 5TH ST
TO 2ND & I-71 EB
TO KY
TO I-71/ 3RD ST.
TO I-71
TO US 50
TO US 50
MOUND ST.
INT. 6
9TH ST.
7TH ST.
6TH ST.
5TH ST.
4TH ST.
3RD ST.
2ND ST.
MATCH LINE
IR-71/IR-75 SB LOWER LEVEL
52050 (61350)
IR-71/IR-75 NB UPPER LEVEL
50400 (58050)
LOCAL SB UPPER LEVEL 34150 (39350)
LOCAL NB LOWER LEVEL 32150 (38000)
CW BAILEY BRIDGE
7850 (7950)
11150 (11450)
7850 (7950)
6850 (7700)
7750 (8000)
3400 (3450)
20700 (23000)
600 (650)
6350 (8250)
5000 (6150)
3100 (4150)
500 (550)
5750 (6550)
4050 (5050)
1400 (1500)
3200 (3700)
5000 (6150)
4000 (4800)
1350 (1400)
5050 (6250)
6300 (8150)
6050 (7050)
C
D
LEGEND
XXX (XXX) = 2029 AADT (2049 AADT)
I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
BRENT SPENCE BRIDGE
2029 & 2049 DAILY TRAFFIC FORECASTS
PLATE 5 OF 10 (OH)
REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS
SEP 2024
NOT TO SCALE
HNTB

MATCH LINE

CENTRAL AVE.

9TH ST.

ELM ST.

7TH ST.

6TH ST.

5TH ST.

4TH ST.

3RD ST.

2ND ST.

PLUM ST.

RACE ST.

INT. 8

INT. 7

600 (1000)
4200 (5050)

4550 (5400)

700 (750)
4050 (4550)

24500 (27550)

13850 (16850)

3100 (3200)
4950 (5350)

1700 (1750)
5950 (6400)

9600 (11000)

2150 (2300)
4200 (4500)

2200 (2450)

2000 (2500)

5300 (5900)

1300 (1750)

1500 (1700)

4000 (4650)

4000 (4150)

4850 (5450)

650 (900)

22850 (25200)

4650 (5300)

10750 (12500)

1500 (1750)
3150 (3550)

11700 (13050)

6050 (7550)

18150 (20250)

62800 (66550)

64800 (70500)

14700 (16550)

4450 (5400)

30050 (34450)

10250 (11150)

18650 (20900)

34000 (38100)

34850 (38550)

30800 (32400)

27950 (28000)

71

50

1350 (1500)
5700 (6800)
150 (200)

1550 (1550)
1550 (1650)

3600 (3850)
2350 (2550)

1700 (1750)

4200 (4500)

1750 (1900)
450 (550)

2350 (2550)
700 (750)

1450 (1550)
700 (750)

700 (750)
1150 (1200)

700 (750)
3450 (3950)
1150 (1200)

600 (1000)

950 (1000)
3600 (4400)

600 (650)
9100 (10500)

2200 (2600)
22800 (25800)
700 (750)

2350 (2800)
1700 (1750)

100 (150)
600 (600)

1950 (2000)
3000 (3350)

1050 (1200)
10300 (13050)
2500 (2600)

150 (250)
500 (650)

1000 (1050)
3850 (4400)

2600 (2850)
20250 (22350)

2400 (2700)
2250 (2600)

5950 (6250)
4800 (6250)

16900 (18950)
1250 (1300)

1950 (2250)
11250 (12550)
1500 (1750)

2700 (3050)
450 (500)

1300 (1750)

4000 (4150)

800 (850)
1200 (1650)

1400 (1600)
100 (100)

N

LEGEND

XXX (XXX) = 2029 AADT (2049 AADT)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

2029 & 2049 DAILY TRAFFIC FORECASTS

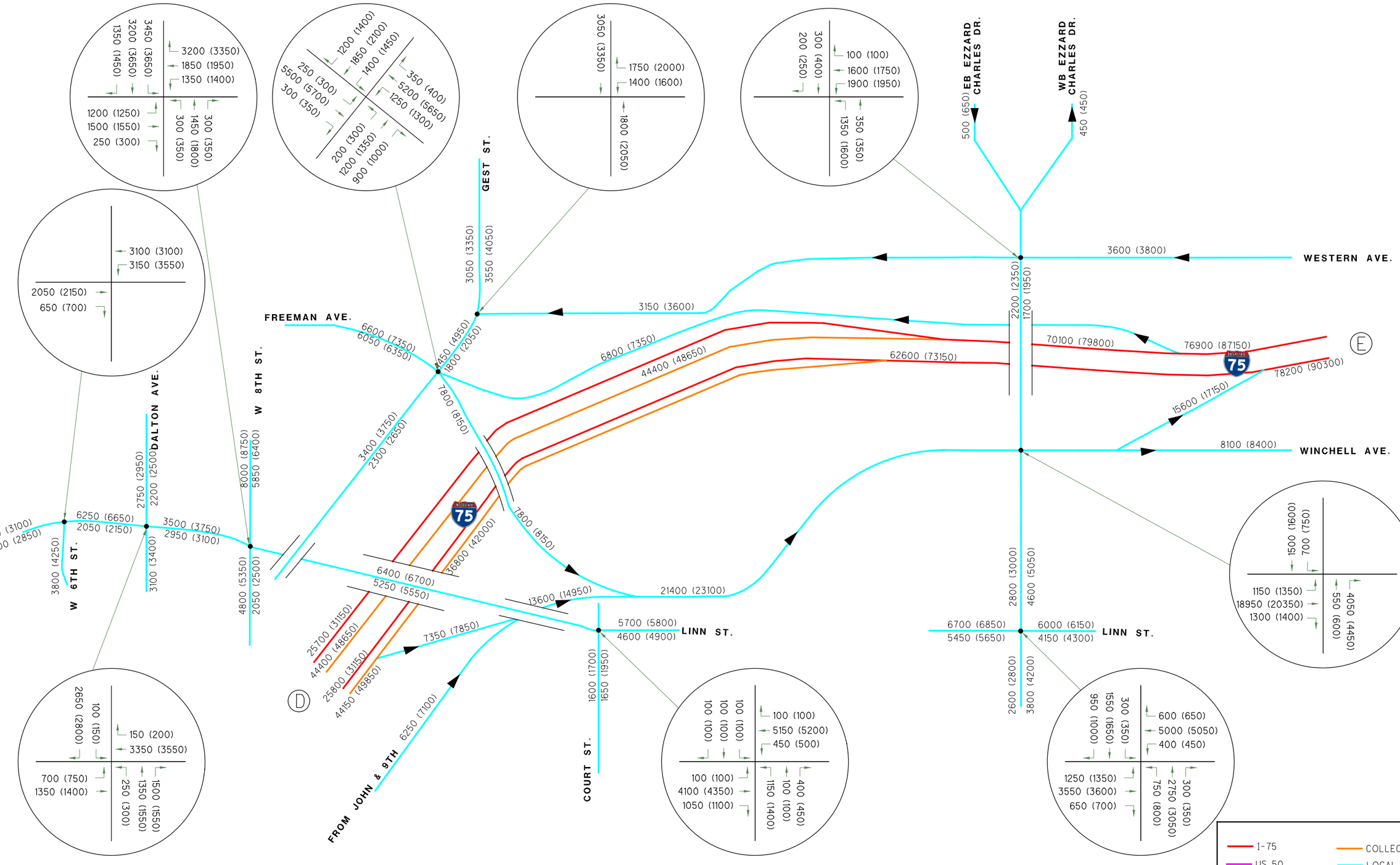
PLATE 6 OF 10 (OH)

REFINED ALTERNATIVE I
(CONCEPT I-W)
INNOVATIONS

SEP 2024

NOT TO SCALE

HNTB



LEGEND

XXX (XXX) = 2029 AADT (2049 AADT)

I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

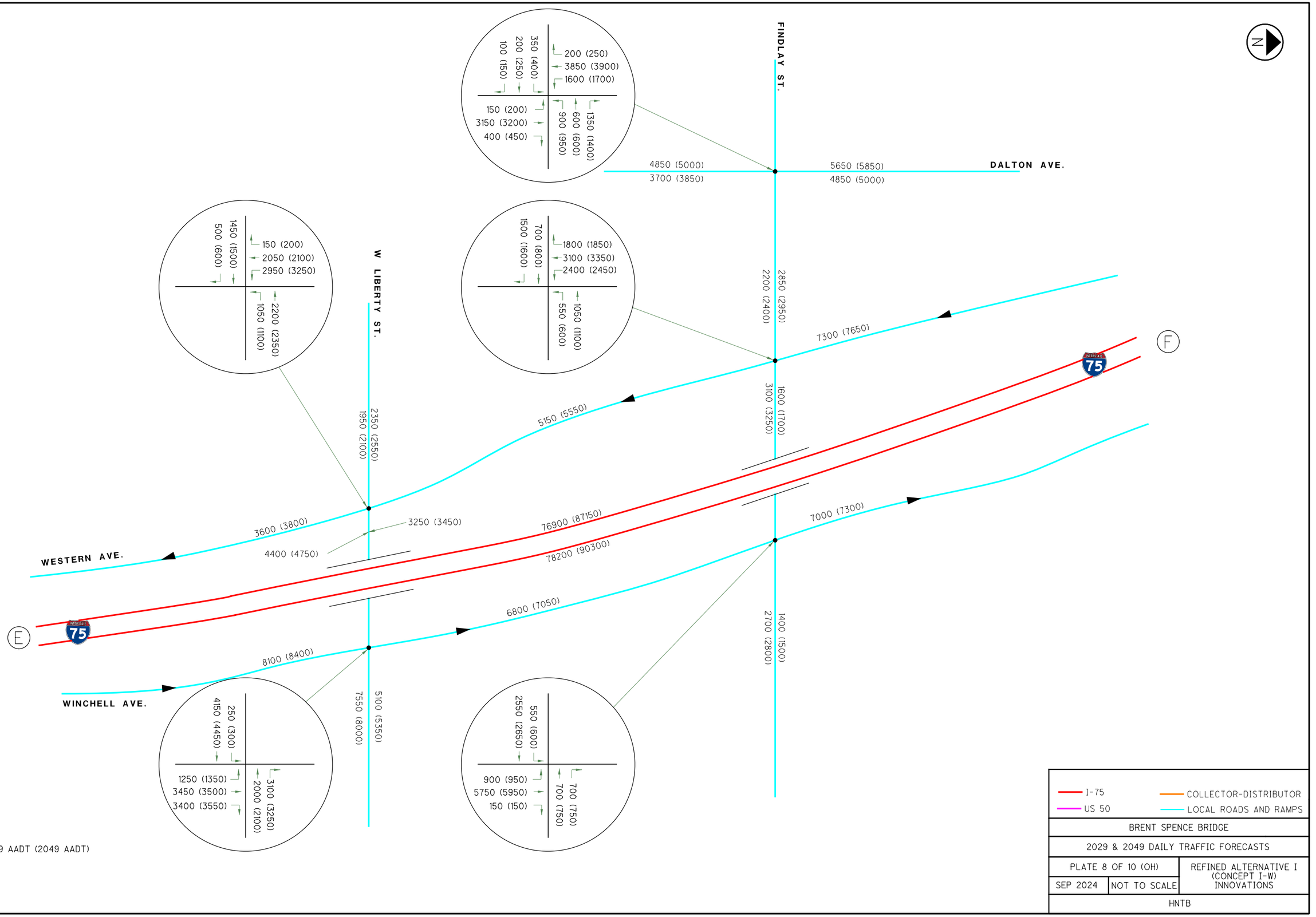
2029 & 2049 DAILY TRAFFIC FORECASTS

PLATE 7 OF 10 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB



LEGEND

XXX (XXX) = 2029 AADT (2049 AADT)

I-75 — COLLECTOR-DISTRIBUTOR

US 50 — LOCAL ROADS AND RAMPS

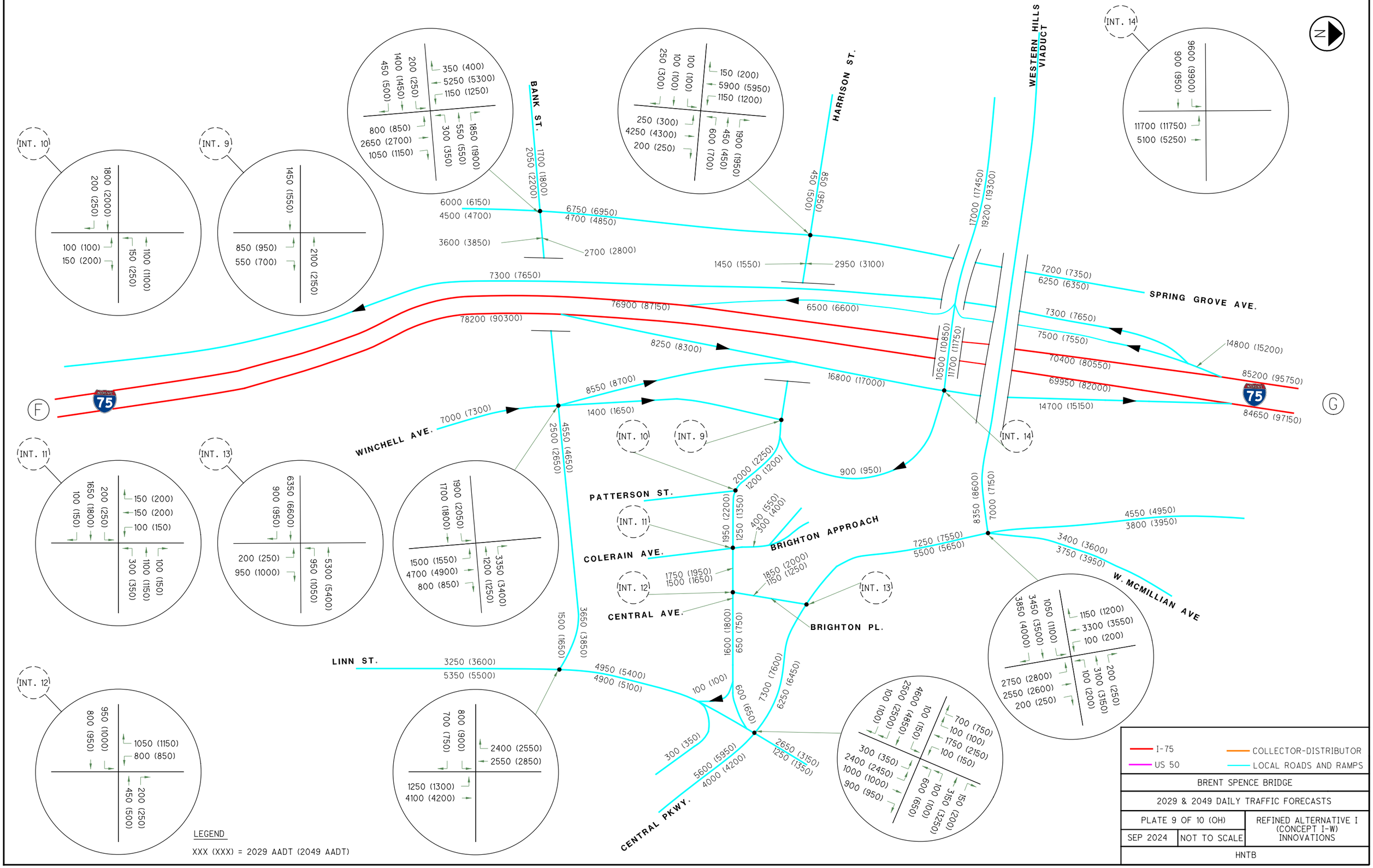
BRENT SPENCE BRIDGE

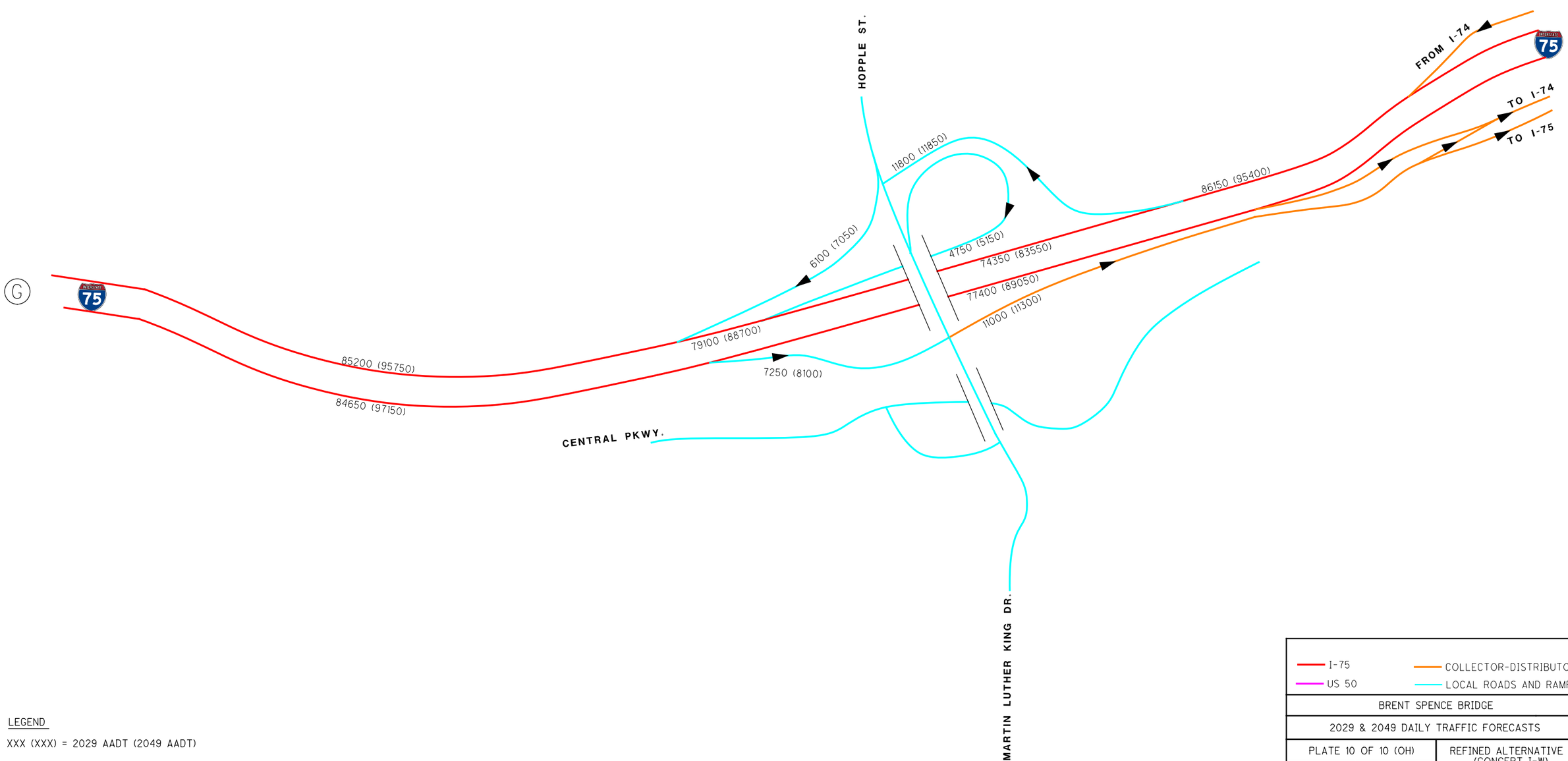
2029 & 2049 DAILY TRAFFIC FORECASTS

PLATE 8 OF 10 (OH) | REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB


BANK ST.
HARRISON ST.
WESTERN HILLS VIADUCT
SPRING GROVE AVE.
WINCHELL AVE.
PATTERSON ST.
COLERAIN AVE.
BRIGHTON APPROACH
W. MCMILLIAN AVE
CENTRAL AVE.
BRIGHTON PL.
LINN ST.
CENTRAL PKWY.
INT. 9
INT. 10
INT. 11
INT. 12
INT. 13
INT. 14
F
G
N
I-75
US 50
LEGEND
XXX (XXX) = 2029 AADT (2049 AADT)
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
BRENT SPENCE BRIDGE
2029 & 2049 DAILY TRAFFIC FORECASTS
PLATE 9 OF 10 (OH)
REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS
SEP 2024
NOT TO SCALE
HNTB



LEGEND

XXX (XXX) = 2029 AADT (2049 AADT)

I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

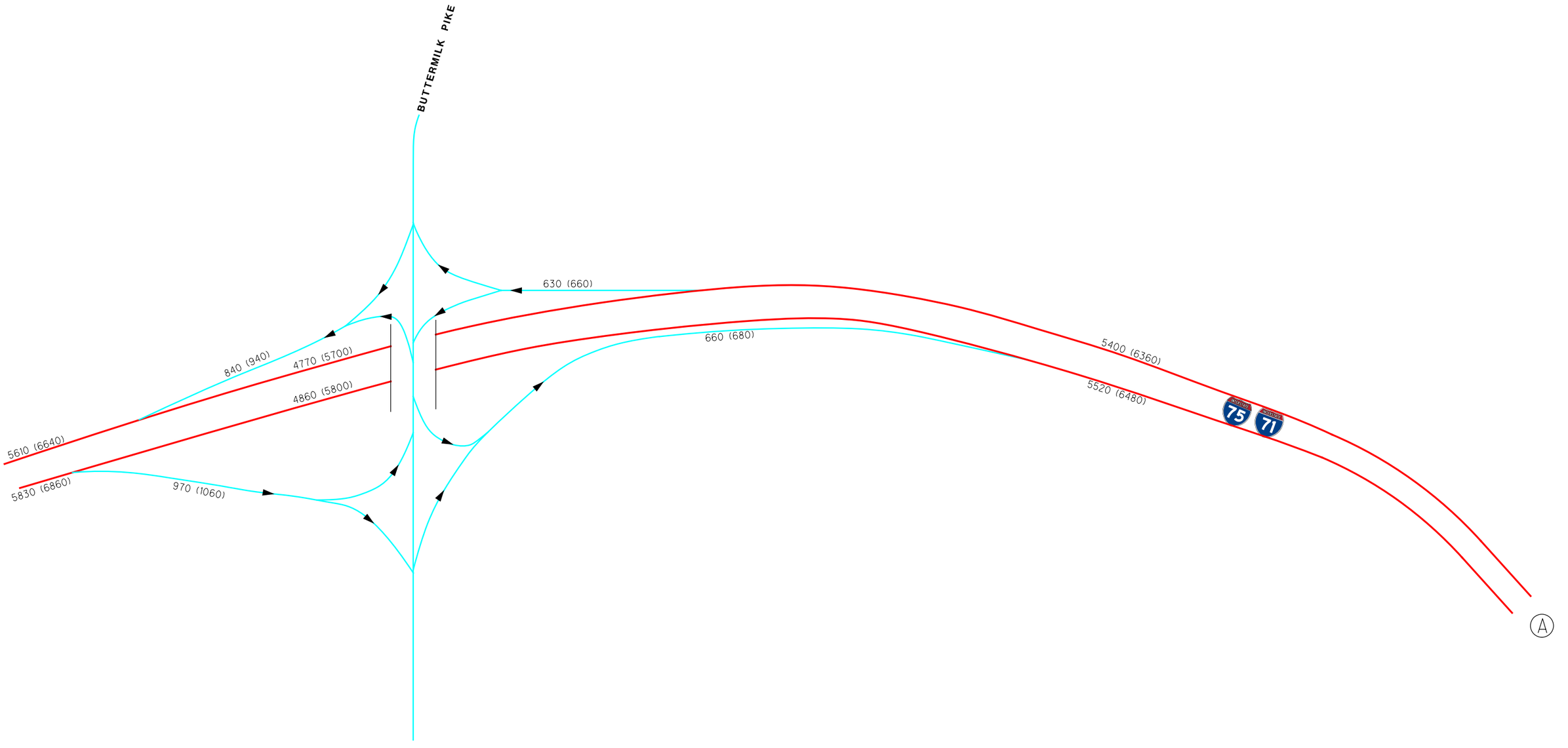
2029 & 2049 DAILY TRAFFIC FORECASTS

PLATE 10 OF 10 (OH)		REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS
SEP 2024	NOT TO SCALE	

HNTB

NOTE

BUTTERMILK DDI CONFIGURATION IS NOT INCLUDED IN BRENT SPENCE BRIDGE PROJECT.

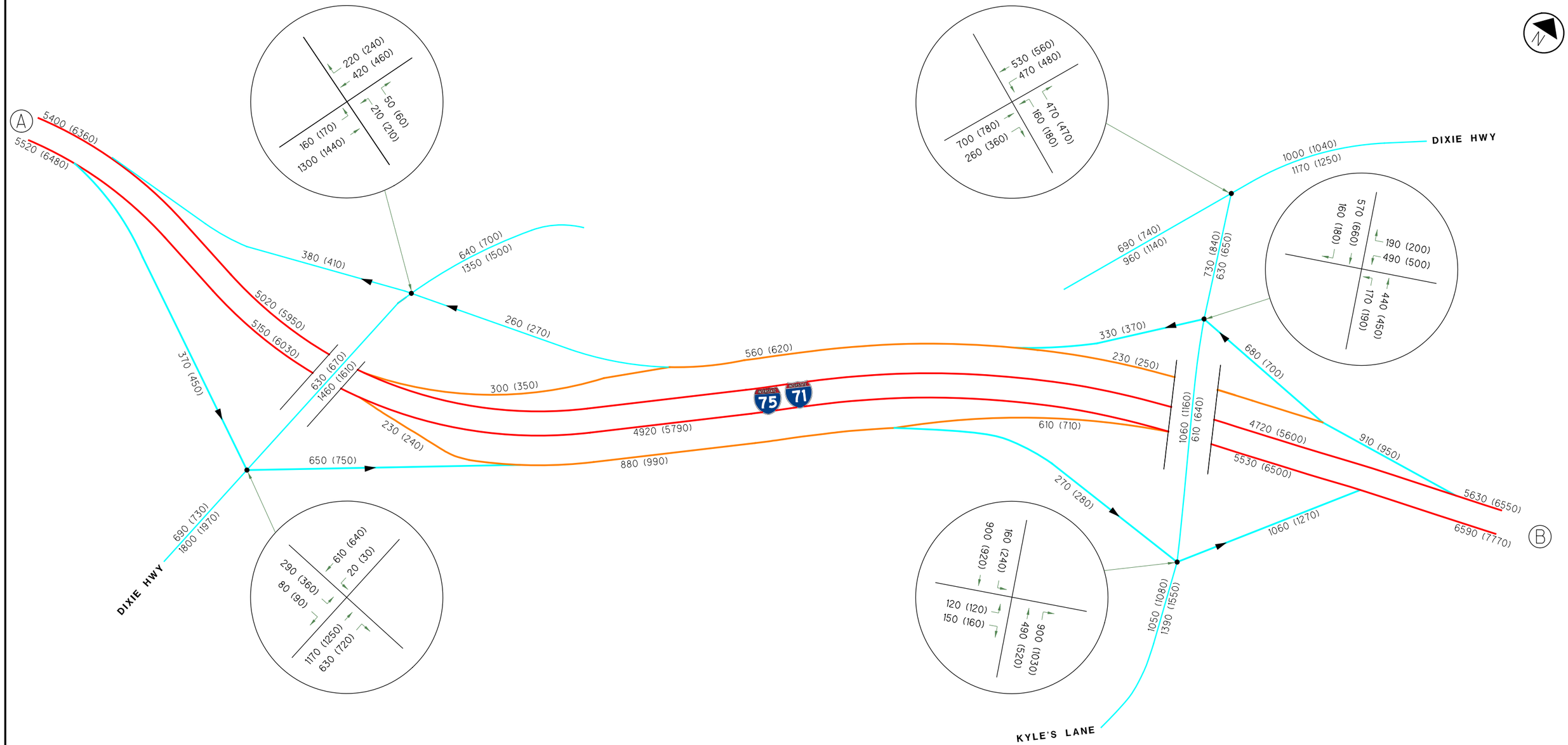


LEGEND

XXX (XXX) = 2029 AM DHV (2049 AM DHV)

I-71/I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE		
2029 & 2049 AM DHV TRAFFIC FORECASTS		
PLATE 1 OF 10 (KY)		REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS
SEP 2024	NOT TO SCALE	
HNTB		



LEGEND

XXX (XXX) = 2029 AM DHV (2049 AM DHV)

BRENT SPENCE BRIDGE

2029 & 2049 AM DHV TRAFFIC FORECASTS

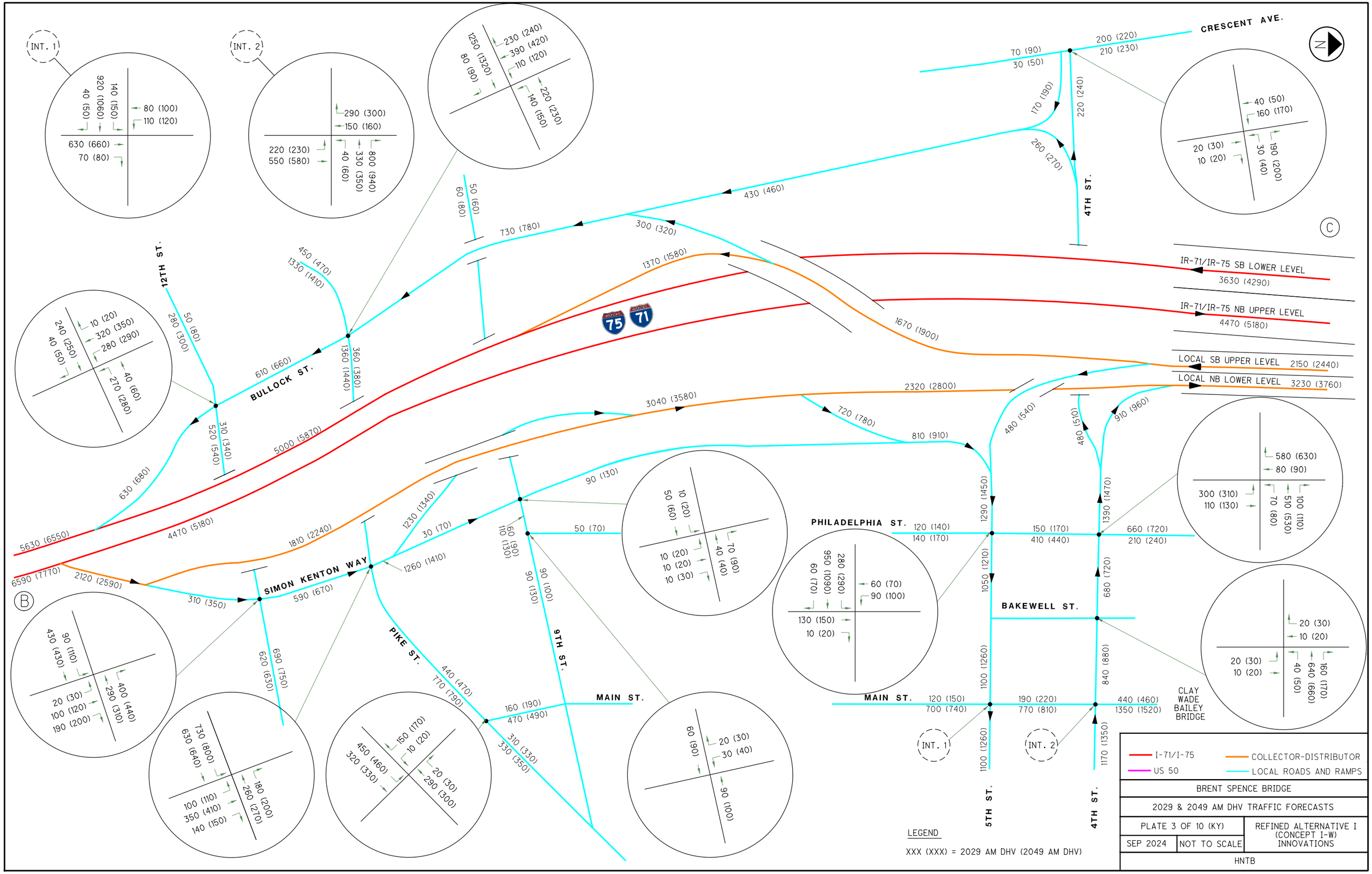
PLATE 2 OF 10 (KY)

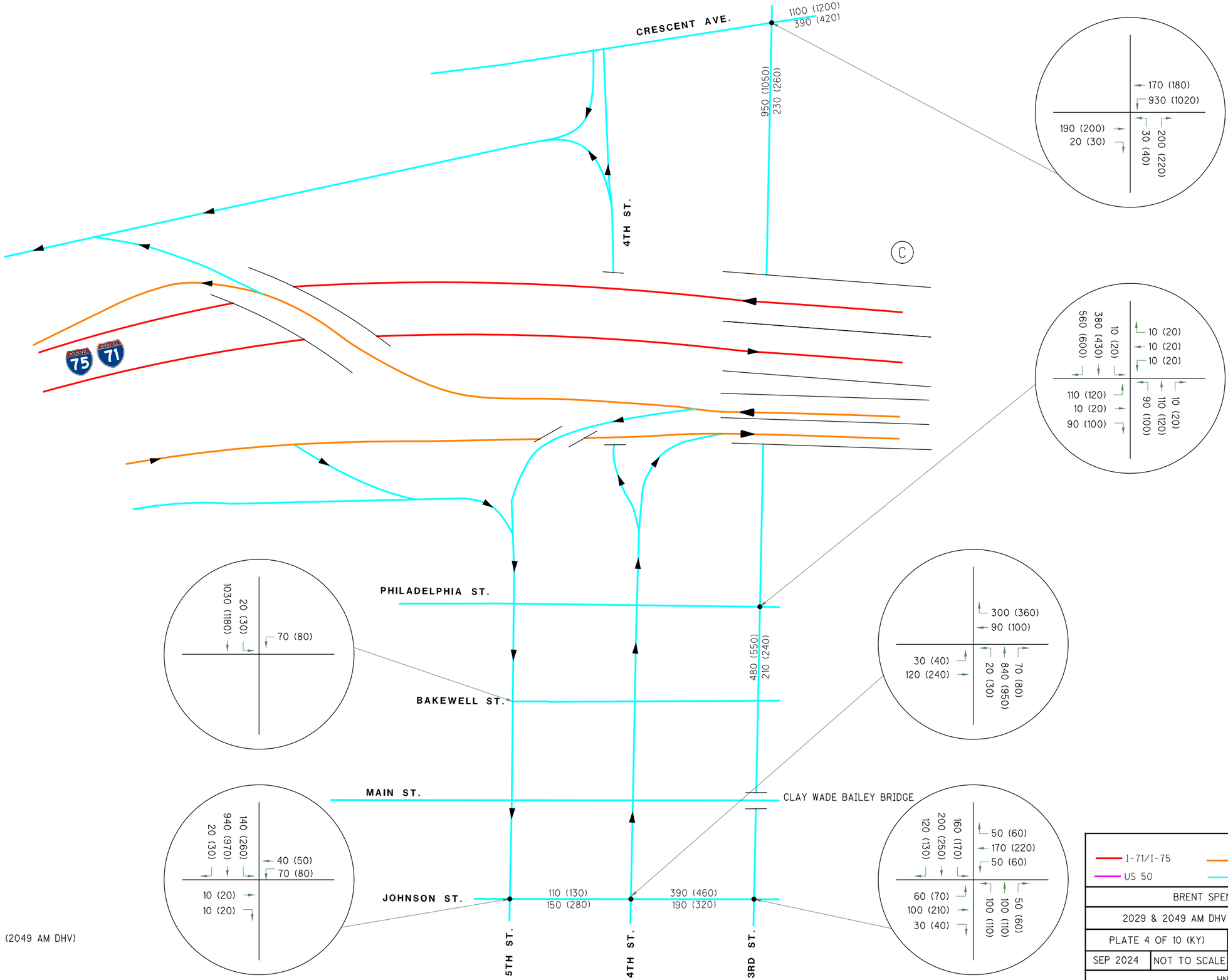
REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024

NOT TO SCALE

HNTB


INT. 1
INT. 2
CRESCENT AVE.
4TH ST.
12TH ST.
BULLOCK ST.
SIMON KENTON WAY
PIKE ST.
9TH ST.
MAIN ST.
PHILADELPHIA ST.
BAKEWELL ST.
5TH ST.
4TH ST.
CLAY WADE BAILEY BRIDGE
IR-71/IR-75 SB LOWER LEVEL 3630 (4290)
IR-71/IR-75 NB UPPER LEVEL 4470 (5180)
LOCAL SB UPPER LEVEL 2150 (2440)
LOCAL NB LOWER LEVEL 3230 (3760)
I-71/I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
LEGEND
XXX (XXX) = 2029 AM DHV (2049 AM DHV)
BRENT SPENCE BRIDGE
2029 & 2049 AM DHV TRAFFIC FORECASTS
PLATE 3 OF 10 (KY)
REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS
SEP 2024
NOT TO SCALE
HNTB



SEE PLATE 3 FOR ADDITIONAL VALUES

LEGEND

XXX (XXX) = 2029 AM DHV (2049 AM DHV)

I-71/I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

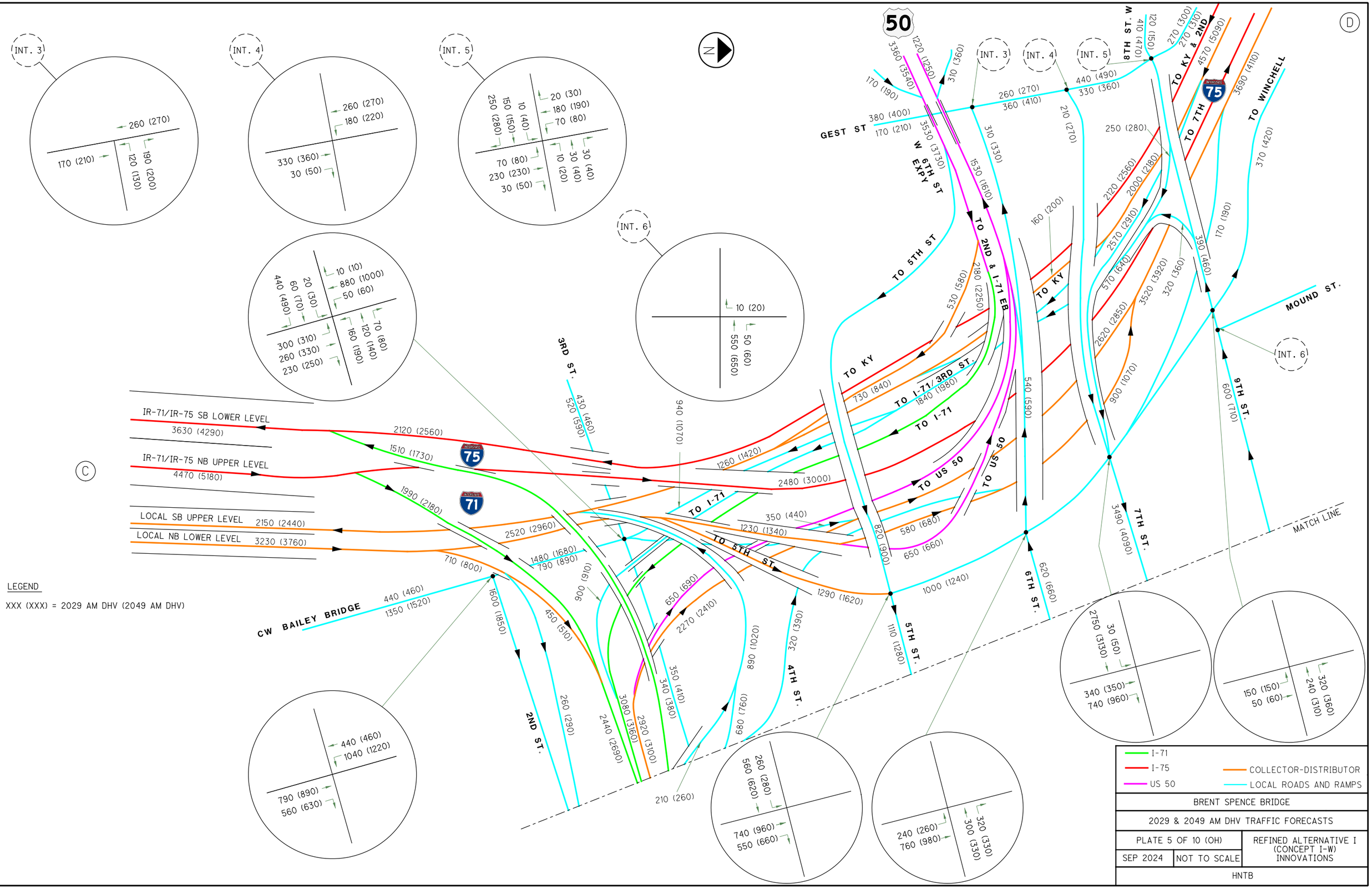
2029 & 2049 AM DHV TRAFFIC FORECASTS

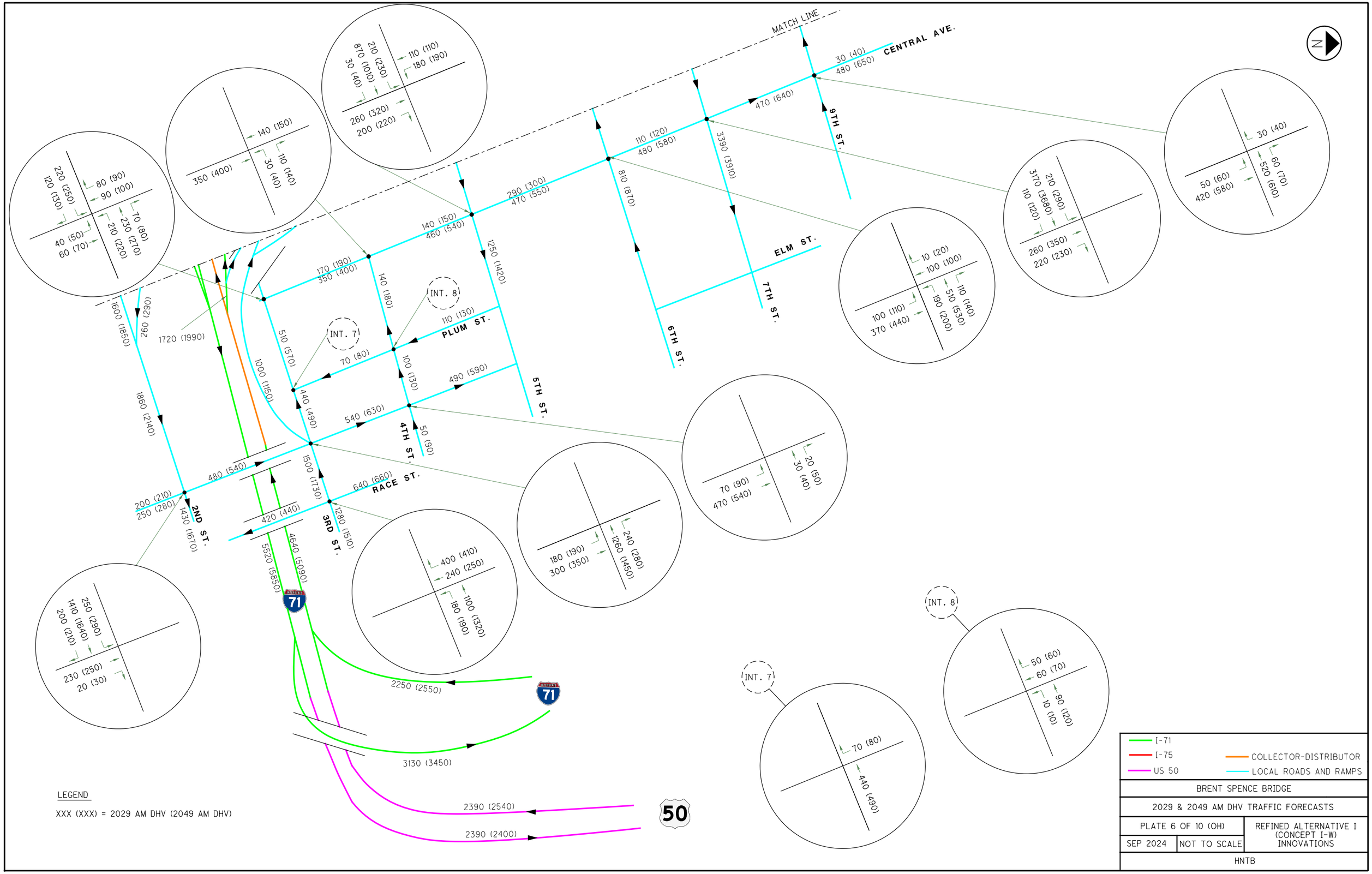
PLATE 4 OF 10 (KY)

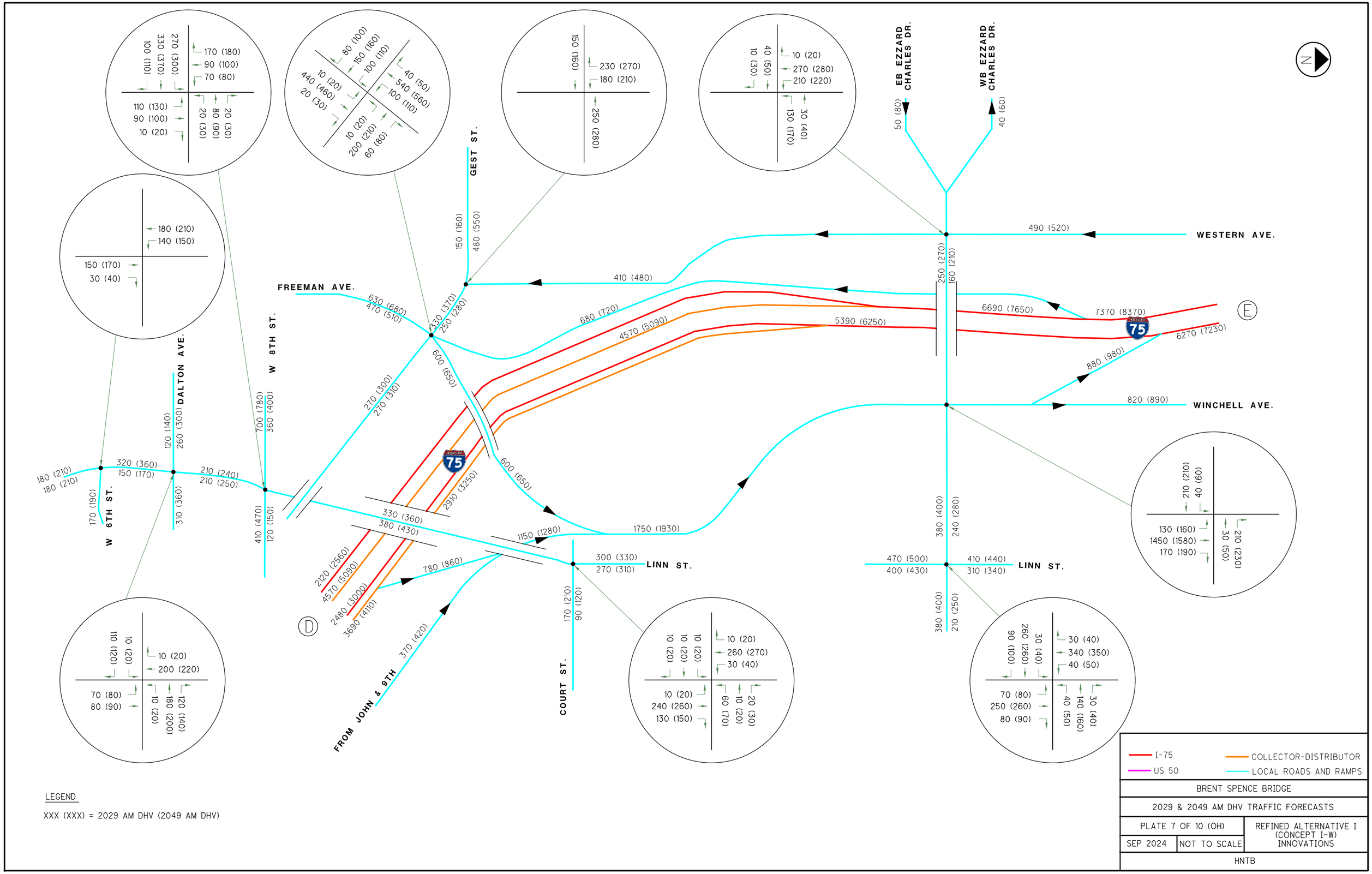
REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB


INT. 3
260 (270)
170 (210)
120 (130)
190 (200)
INT. 4
260 (270)
180 (220)
330 (360)
30 (50)
INT. 5
20 (30)
180 (190)
70 (80)
250 (280)
150 (150)
10 (40)
70 (80)
230 (230)
30 (50)
10 (20)
30 (40)
INT. 6
10 (20)
50 (60)
550 (650)
940 (1070)
N
D
C
50
INT. 3
INT. 4
INT. 5
8TH ST. W
120 (150)
410 (470)
270 (300)
270 (310)
TO KY & 2ND
4570 (5090)
3690 (4110)
TO WINCHELL
370 (420)
TO 7TH
75
1220 (1250)
3360 (3540)
310 (360)
170 (190)
GEST ST
380 (400)
170 (210)
260 (270)
360 (410)
440 (490)
330 (360)
210 (270)
250 (280)
W 6TH ST EXPY
3530 (3730)
310 (330)
1530 (1610)
TO 5TH ST
TO 2ND & I-71 EB
160 (200)
TO KY
2120 (2560)
2000 (2180)
2570 (2910)
570 (640)
3520 (3920)
320 (360)
390 (460)
170 (190)
MOUND ST.
INT. 6
530 (580)
2180 (2250)
TO KY
730 (840)
TO I-71/ 3RD ST.
1840 (1980)
TO I-71
540 (590)
2620 (2850)
900 (1070)
9TH ST.
600 (710)
3RD ST.
430 (460)
520 (590)
940 (1070)
IR-71/IR-75 SB LOWER LEVEL
3630 (4290)
2120 (2560)
1510 (1730)
IR-71/IR-75 NB UPPER LEVEL
4470 (5180)
1990 (2180)
1260 (1420)
2480 (3000)
TO US 50
TO US 50
LOCAL SB UPPER LEVEL 2150 (2440)
LOCAL NB LOWER LEVEL 3230 (3760)
TO I-71
350 (440)
1230 (1340)
580 (680)
650 (660)
820 (900)
2520 (2960)
1480 (1680)
790 (890)
TO 5TH ST
7TH ST.
3490 (4090)
MATCH LINE
710 (800)
900 (910)
650 (690)
2270 (2410)
1290 (1620)
1000 (1240)
6TH ST.
620 (660)
CW BAILEY BRIDGE
440 (460)
1350 (1520)
1600 (1850)
450 (510)
2ND ST.
260 (290)
2440 (2690)
3080 (3160)
2920 (3100)
350 (410)
340 (380)
890 (1020)
320 (390)
4TH ST.
680 (760)
210 (260)
1110 (1280)
5TH ST.
2750 (3130)
30 (50)
340 (350)
740 (960)
150 (150)
50 (60)
320 (360)
240 (310)
440 (460)
1040 (1220)
790 (890)
560 (630)
260 (280)
560 (620)
740 (960)
550 (660)
240 (260)
760 (980)
320 (330)
300 (330)
LEGEND
XXX (XXX) = 2029 AM DHV (2049 AM DHV)
I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
BRENT SPENCE BRIDGE
2029 & 2049 AM DHV TRAFFIC FORECASTS
PLATE 5 OF 10 (OH)
REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS
SEP 2024
NOT TO SCALE
HNTB


MATCH LINE
CENTRAL AVE.
9TH ST.
7TH ST.
6TH ST.
5TH ST.
4TH ST.
3RD ST.
2ND ST.
ELM ST.
PLUM ST.
RACE ST.
INT. 7
INT. 8
30 (40)
480 (650)
470 (640)
110 (120)
480 (580)
3390 (3910)
290 (300)
470 (550)
810 (870)
140 (150)
460 (540)
170 (190)
350 (400)
140 (180)
1250 (1420)
110 (130)
70 (80)
100 (130)
510 (570)
1000 (1150)
440 (490)
490 (590)
540 (630)
50 (90)
1600 (1850)
260 (290)
1720 (1990)
1860 (2140)
480 (540)
1500 (1730)
640 (660)
200 (210)
250 (280)
1430 (1670)
420 (440)
1280 (1510)
4640 (5090)
5520 (5850)
2250 (2550)
3130 (3450)
2390 (2540)
2390 (2400)
210 (230)
870 (1010)
30 (40)
110 (110)
180 (190)
260 (320)
200 (220)
140 (150)
350 (400)
110 (140)
30 (40)
220 (250)
120 (130)
80 (90)
90 (100)
40 (50)
60 (70)
70 (80)
230 (270)
210 (220)
210 (290)
3170 (3680)
110 (120)
260 (350)
220 (230)
30 (40)
60 (70)
50 (60)
420 (580)
520 (610)
10 (20)
100 (100)
100 (110)
370 (440)
110 (140)
510 (530)
190 (200)
400 (410)
240 (250)
180 (190)
1100 (1320)
180 (190)
300 (350)
240 (280)
1260 (1450)
70 (90)
470 (540)
20 (50)
30 (40)
250 (290)
1410 (1640)
200 (210)
230 (250)
20 (30)
50 (60)
60 (70)
90 (120)
10 (10)
70 (80)
440 (490)
N
I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
LEGEND
XXX (XXX) = 2029 AM DHV (2049 AM DHV)
BRENT SPENCE BRIDGE
2029 & 2049 AM DHV TRAFFIC FORECASTS
PLATE 6 OF 10 (OH)
REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS
SEP 2024
NOT TO SCALE
HNTB



LEGEND

XXX (XXX) = 2029 AM DHV (2049 AM DHV)

I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

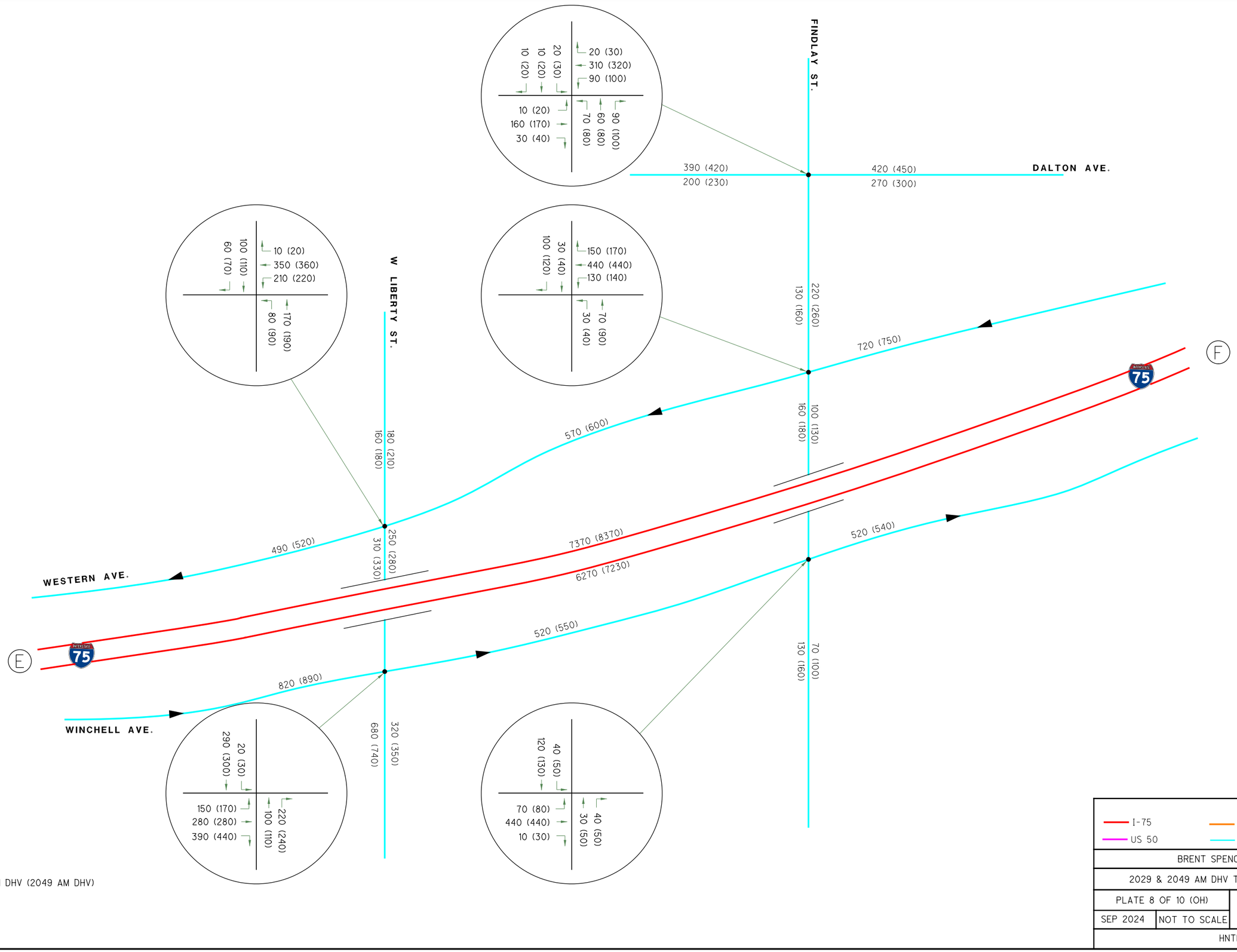
2029 & 2049 AM DHV TRAFFIC FORECASTS

PLATE 7 OF 10 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB



LEGEND

XXX (XXX) = 2029 AM DHV (2049 AM DHV)

I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

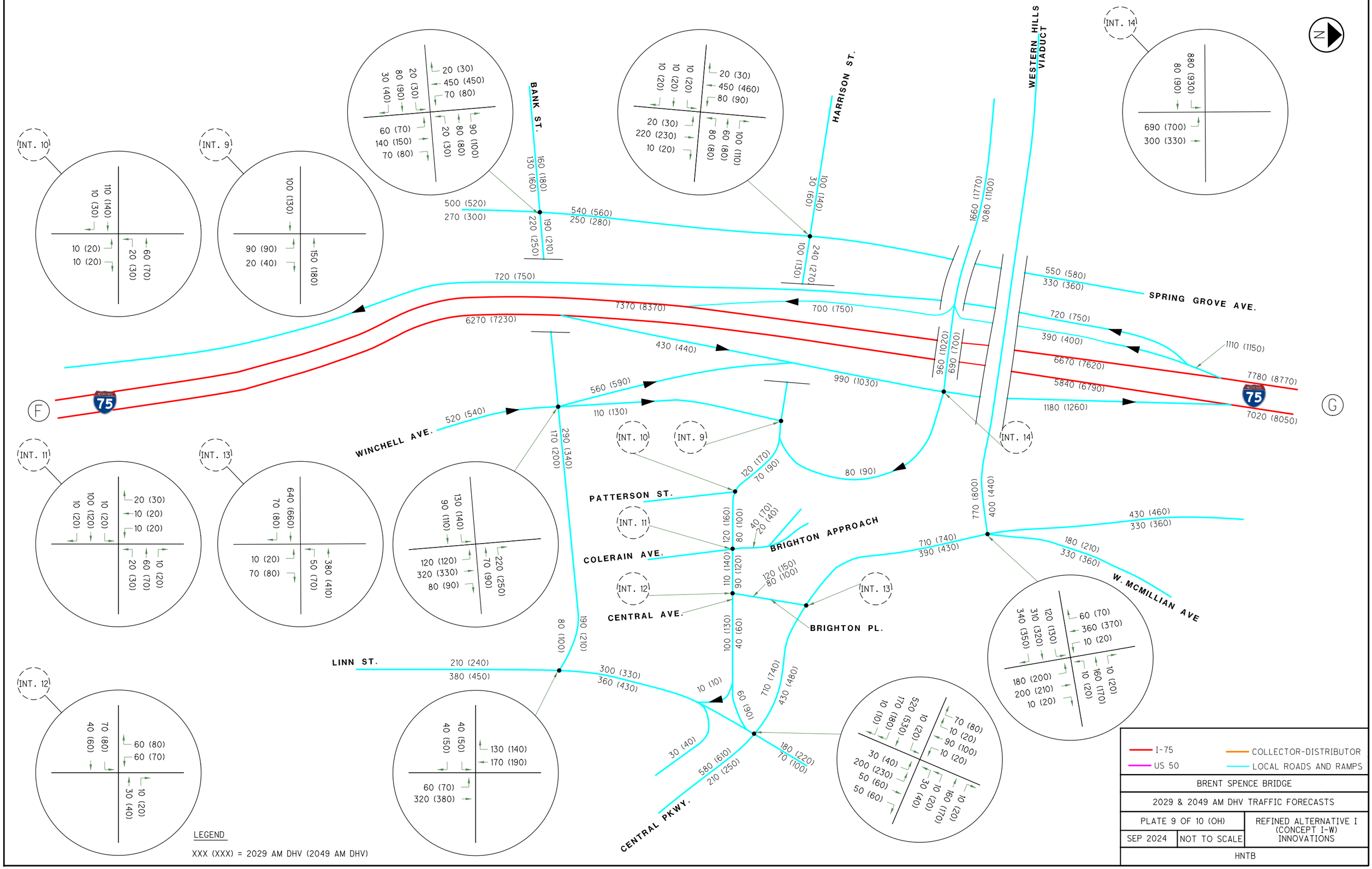
2029 & 2049 AM DHV TRAFFIC FORECASTS

PLATE 8 OF 10 (OH)

REFINED ALTERNATIVE I
(CONCEPT I-W)
INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB



LEGEND

XXX (XXX) = 2029 AM DHV (2049 AM DHV)

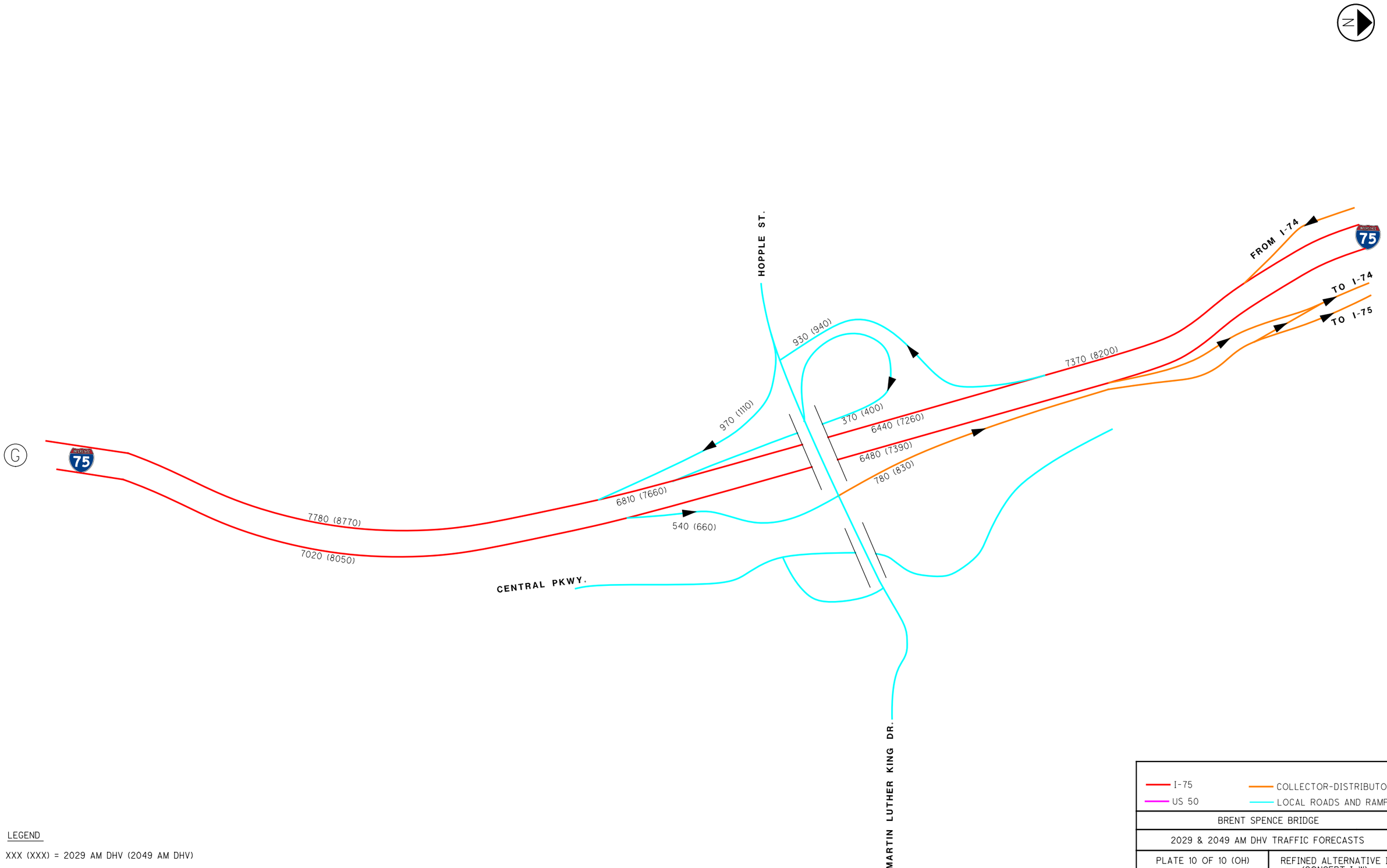
BRENT SPENCE BRIDGE

2029 & 2049 AM DHV TRAFFIC FORECASTS

PLATE 9 OF 10 (OH) | REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB



LEGEND

XXX (XXX) = 2029 AM DHV (2049 AM DHV)

I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

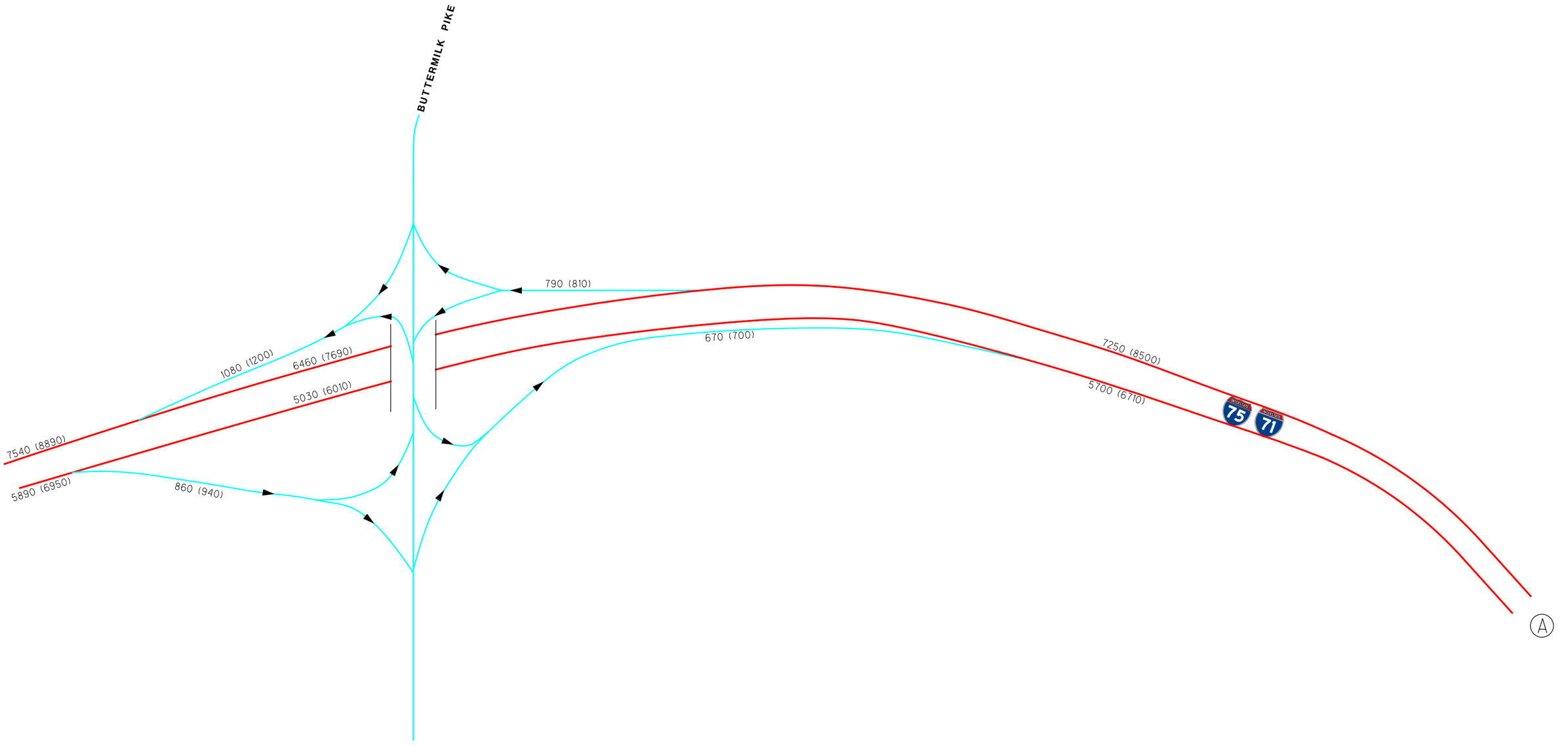
2029 & 2049 AM DHV TRAFFIC FORECASTS

PLATE 10 OF 10 (OH)		REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS
SEP 2024	NOT TO SCALE	

HNTB

NOTE

BUTTERMILK DDI CONFIGURATION IS NOT INCLUDED IN BRENT SPENCE BRIDGE PROJECT.



LEGEND

XXX (XXX) = 2029 PM DHV (2049 PM DHV)

I-71/I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

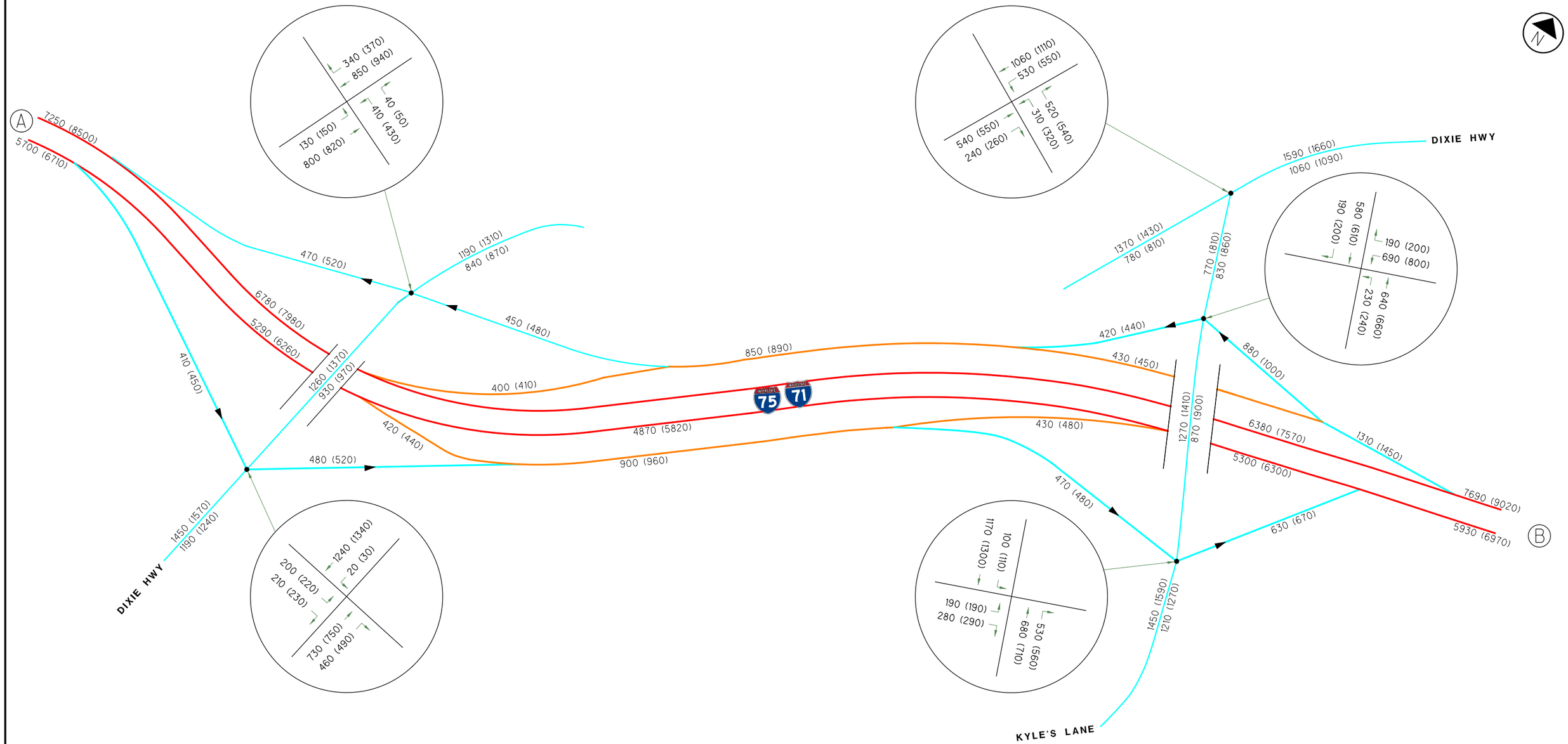
2029 & 2049 PM DHV TRAFFIC FORECASTS

PLATE 1 OF 10 (KY)

REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB



LEGEND

XXX (XXX) = 2029 PM DHV (2049 PM DHV)

I-71/I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

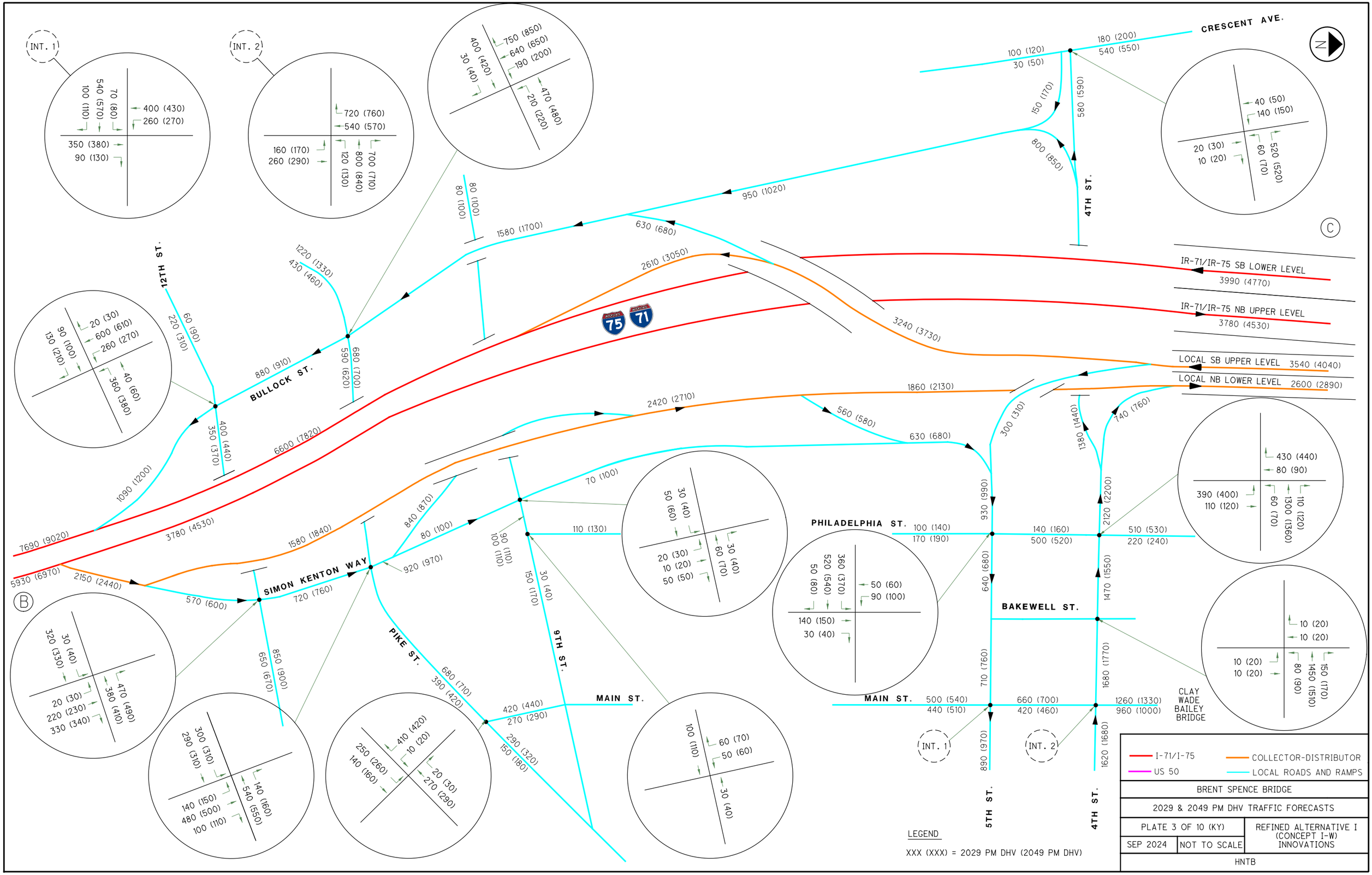
2029 & 2049 PM DHV TRAFFIC FORECASTS

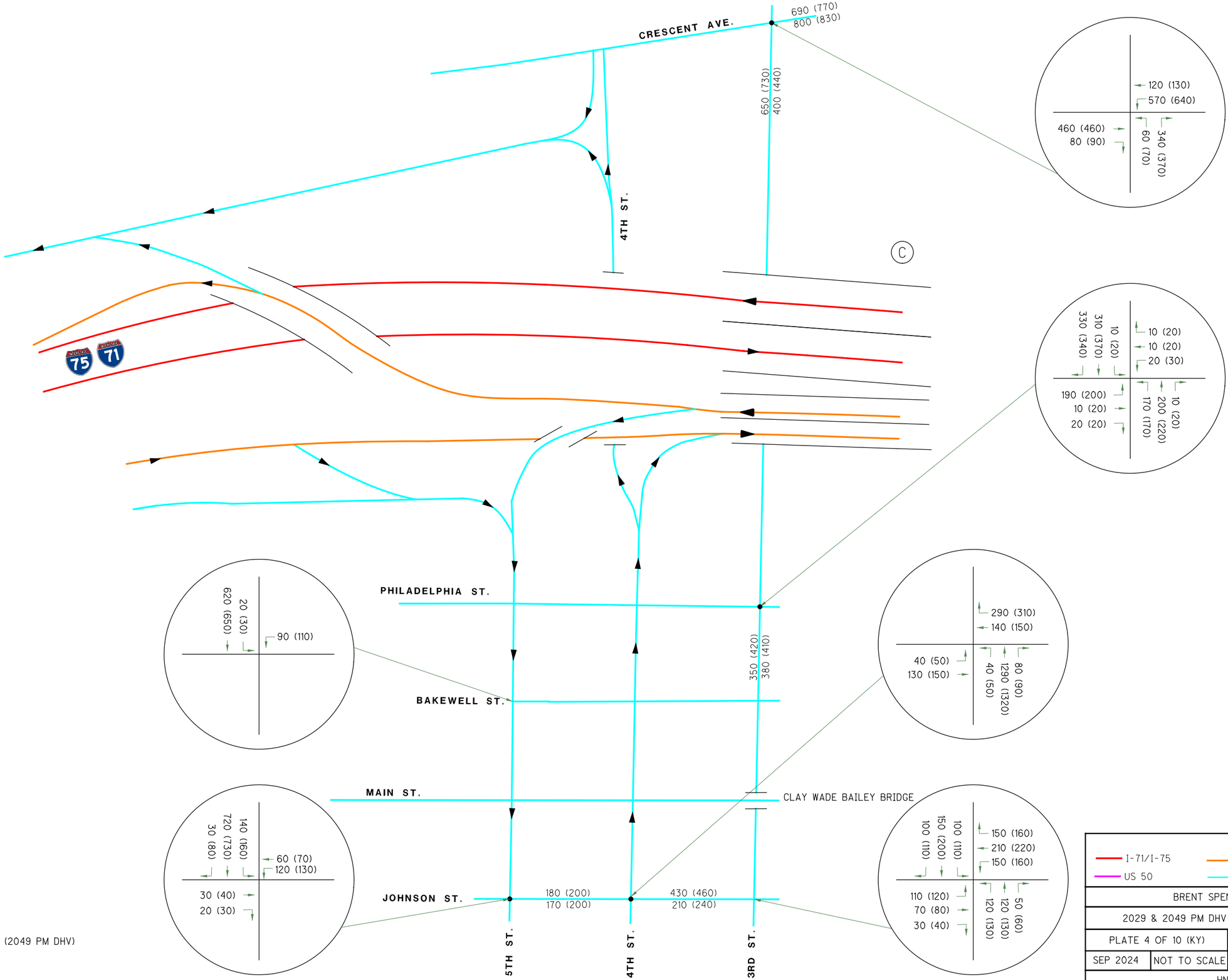
PLATE 2 OF 10 (KY)

REFINED ALTERNATIVE I
(CONCEPT I-W)
INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB


INT. 1
100 (110)
540 (570)
70 (80)
400 (430)
260 (270)
350 (380)
90 (130)
INT. 2
720 (760)
540 (570)
160 (170)
260 (290)
120 (130)
800 (840)
700 (710)
400 (420)
30 (40)
750 (850)
640 (650)
190 (200)
210 (220)
470 (480)
CRESCENT AVE.
100 (120)
30 (50)
180 (200)
540 (550)
150 (170)
580 (590)
800 (850)
4TH ST.
40 (50)
140 (150)
20 (30)
10 (20)
60 (70)
520 (520)
N
C
80 (100)
80 (100)
1580 (1700)
950 (1020)
630 (680)
2610 (3050)
1220 (1330)
430 (460)
12TH ST.
60 (90)
220 (310)
880 (910)
BULLOCK ST.
590 (620)
680 (700)
3240 (3730)
IR-71/IR-75 SB LOWER LEVEL
3990 (4770)
IR-71/IR-75 NB UPPER LEVEL
3780 (4530)
LOCAL SB UPPER LEVEL 3540 (4040)
LOCAL NB LOWER LEVEL 2600 (2890)
20 (30)
600 (610)
260 (270)
90 (100)
130 (210)
360 (380)
40 (60)
400 (440)
350 (370)
6600 (7820)
1090 (1200)
2420 (2710)
1860 (2130)
560 (580)
630 (680)
300 (310)
1380 (1440)
740 (760)
430 (440)
80 (90)
390 (400)
110 (120)
60 (70)
1300 (1360)
110 (120)
70 (100)
840 (870)
80 (100)
110 (130)
90 (110)
100 (110)
150 (170)
30 (40)
9TH ST.
30 (40)
50 (60)
20 (30)
10 (20)
50 (50)
60 (70)
30 (40)
PHILADELPHIA ST.
100 (140)
170 (190)
930 (990)
140 (160)
500 (520)
2120 (2200)
510 (530)
220 (240)
7690 (9020)
3780 (4530)
1580 (1840)
5930 (6970)
2150 (2440)
570 (600)
SIMON KENTON WAY
720 (760)
920 (970)
640 (680)
BAKEWELL ST.
1470 (1550)
360 (370)
520 (540)
50 (80)
50 (60)
90 (100)
140 (150)
30 (40)
10 (20)
10 (20)
10 (20)
10 (20)
80 (90)
1450 (1510)
150 (170)
B
30 (40)
320 (330)
20 (30)
220 (230)
330 (340)
380 (410)
470 (490)
850 (900)
650 (670)
PIKE ST.
680 (710)
390 (420)
420 (440)
270 (290)
MAIN ST.
290 (320)
150 (180)
710 (760)
1680 (1770)
MAIN ST.
500 (540)
440 (510)
660 (700)
420 (460)
1260 (1330)
960 (1000)
CLAY WADE BAILEY BRIDGE
300 (310)
290 (310)
140 (150)
480 (500)
100 (110)
140 (160)
540 (550)
410 (420)
250 (260)
140 (160)
10 (20)
20 (30)
270 (290)
100 (110)
60 (70)
50 (60)
30 (40)
INT. 1
INT. 2
890 (970)
1620 (1680)
5TH ST.
4TH ST.
I-71/I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
LEGEND
XXX (XXX) = 2029 PM DHV (2049 PM DHV)
BRENT SPENCE BRIDGE
2029 & 2049 PM DHV TRAFFIC FORECASTS
PLATE 3 OF 10 (KY)
REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS
SEP 2024
NOT TO SCALE
HNTB



LEGEND

XXX (XXX) = 2029 PM DHV (2049 PM DHV)

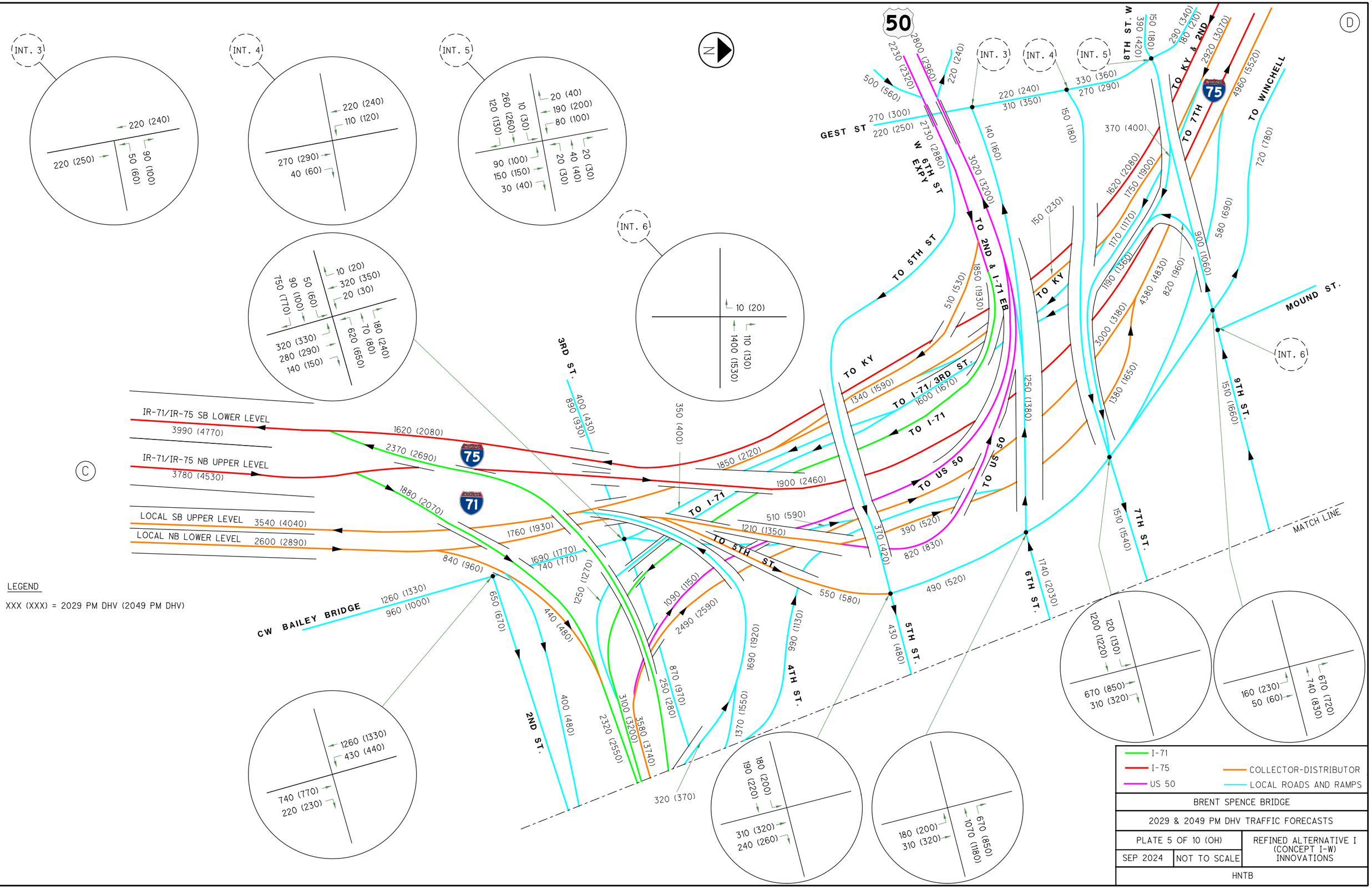
I-71/I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

2029 & 2049 PM DHV TRAFFIC FORECASTS

PLATE 4 OF 10 (KY)		REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS
SEP 2024	NOT TO SCALE	

HNTB


INT. 3
220 (240)
220 (250)
50 (60)
90 (100)
INT. 4
220 (240)
110 (120)
270 (290)
40 (60)
INT. 5
20 (40)
190 (200)
80 (100)
260 (260)
10 (30)
120 (130)
90 (100)
150 (150)
30 (40)
20 (30)
40 (40)
20 (30)
INT. 6
10 (20)
1400 (1530)
110 (130)
10 (20)
320 (350)
20 (30)
750 (770)
90 (100)
50 (60)
320 (330)
280 (290)
140 (150)
70 (80)
620 (650)
180 (240)
N
50
2800 (2960)
2230 (2320)
220 (240)
500 (560)
270 (300)
220 (250)
GEST ST
W 6TH EXPY ST
2730 (2880)
140 (160)
3020 (3200)
150 (180)
220 (240)
310 (350)
330 (360)
270 (290)
8TH ST. W
150 (180)
390 (420)
290 (340)
180 (210)
TO KY & 2ND
2920 (3070)
4960 (5520)
TO WINCHELL
720 (780)
370 (400)
1620 (2080)
1750 (1900)
1170 (1170)
580 (690)
900 (1060)
1190 (1360)
4380 (4830)
820 (960)
3000 (3180)
1380 (1650)
MOUND ST.
INT. 6
9TH ST.
1510 (1660)
7TH ST.
1510 (1540)
TO 7TH
TO 5TH ST
TO 2ND & I-71 EB
150 (230)
TO KY
510 (530)
1850 (1930)
TO KY
1340 (1590)
TO I-71/3RD ST.
1600 (1670)
TO I-71
1250 (1380)
TO US 50
TO US 50
370 (420)
390 (520)
820 (830)
490 (520)
6TH ST.
1740 (2030)
5TH ST.
430 (480)
550 (580)
TO 5TH ST
510 (590)
1210 (1350)
TO I-71
1760 (1930)
1690 (1770)
740 (770)
840 (960)
1250 (1270)
1090 (1150)
2490 (2590)
870 (970)
250 (280)
3100 (3200)
3580 (3740)
2320 (2550)
400 (480)
650 (670)
2ND ST.
440 (480)
1260 (1330)
960 (1000)
CW BAILEY BRIDGE
1690 (1920)
990 (1130)
4TH ST.
1370 (1550)
320 (370)
3RD ST.
400 (430)
890 (930)
350 (400)
1620 (2080)
2370 (2690)
1880 (2070)
1850 (2120)
1900 (2460)
IR-71/IR-75 SB LOWER LEVEL
3990 (4770)
IR-71/IR-75 NB UPPER LEVEL
3780 (4530)
LOCAL SB UPPER LEVEL 3540 (4040)
LOCAL NB LOWER LEVEL 2600 (2890)
C
MATCH LINE
INT. 3
INT. 4
INT. 5
INT. 6
1260 (1330)
430 (440)
740 (770)
220 (230)
180 (200)
190 (220)
310 (320)
240 (260)
180 (200)
310 (320)
670 (850)
1070 (1180)
120 (130)
1200 (1220)
670 (850)
310 (320)
160 (230)
50 (60)
670 (720)
740 (830)
LEGEND
XXX (XXX) = 2029 PM DHV (2049 PM DHV)
I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
BRENT SPENCE BRIDGE
2029 & 2049 PM DHV TRAFFIC FORECASTS
PLATE 5 OF 10 (OH)
REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS
SEP 2024
NOT TO SCALE
HNTB

MATCH LINE

CENTRAL AVE.

80 (130)
300 (360)

390 (440)

9TH ST.

90 (110)
400 (450)

1430 (1440)

1960 (2270)

390 (410)
480 (510)

240 (250)
620 (670)

720 (800)

290 (340)
490 (520)

180 (240)

INT. 8

210 (280)

PLUM ST.

INT. 7

160 (220)

820 (900)

2360 (2680)

660 (680)

130 (180)

320 (350)

390 (400)

5TH ST.

4TH ST.

60 (130)

ELM ST.

7TH ST.

6TH ST.

650 (670)

400 (480)

2690 (3060)

1050 (1150)

540 (570)

2870 (3190)

1700 (1800)

RACE ST.

120 (160)
390 (420)

2ND ST.

780 (840)

920 (1010)

3RD ST.

2090 (2400)

5420 (5750)

6270 (6800)

3340 (3720)

2270 (2540)

2930 (3080)

3150 (3210)

71

50

N

180 (190)
70 (90)
210 (240)
80 (100)
110 (120)
150 (160)
110 (120)
550 (610)
160 (170)

240 (250)
490 (520)
50 (90)
130 (150)

90 (100)
330 (360)
10 (20)
230 (230)
160 (180)
390 (410)
230 (260)

30 (40)
60 (70)
210 (230)
270 (280)
330 (340)
1500 (1760)
130 (170)

130 (140)
1290 (1290)
90 (110)
260 (300)
140 (150)

80 (130)
130 (130)
260 (310)
40 (50)
1300 (1400)

910 (930)
790 (870)
130 (140)
1960 (2260)

350 (380)
190 (190)
2670 (2980)
200 (210)

80 (90)
310 (310)
50 (90)
10 (40)

220 (230)
710 (760)
120 (160)
320 (340)
70 (80)

INT. 7

160 (220)
660 (680)

INT. 8

60 (70)
150 (210)
10 (10)
120 (170)

LEGEND

XXX (XXX) = 2029 PM DHV (2049 PM DHV)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

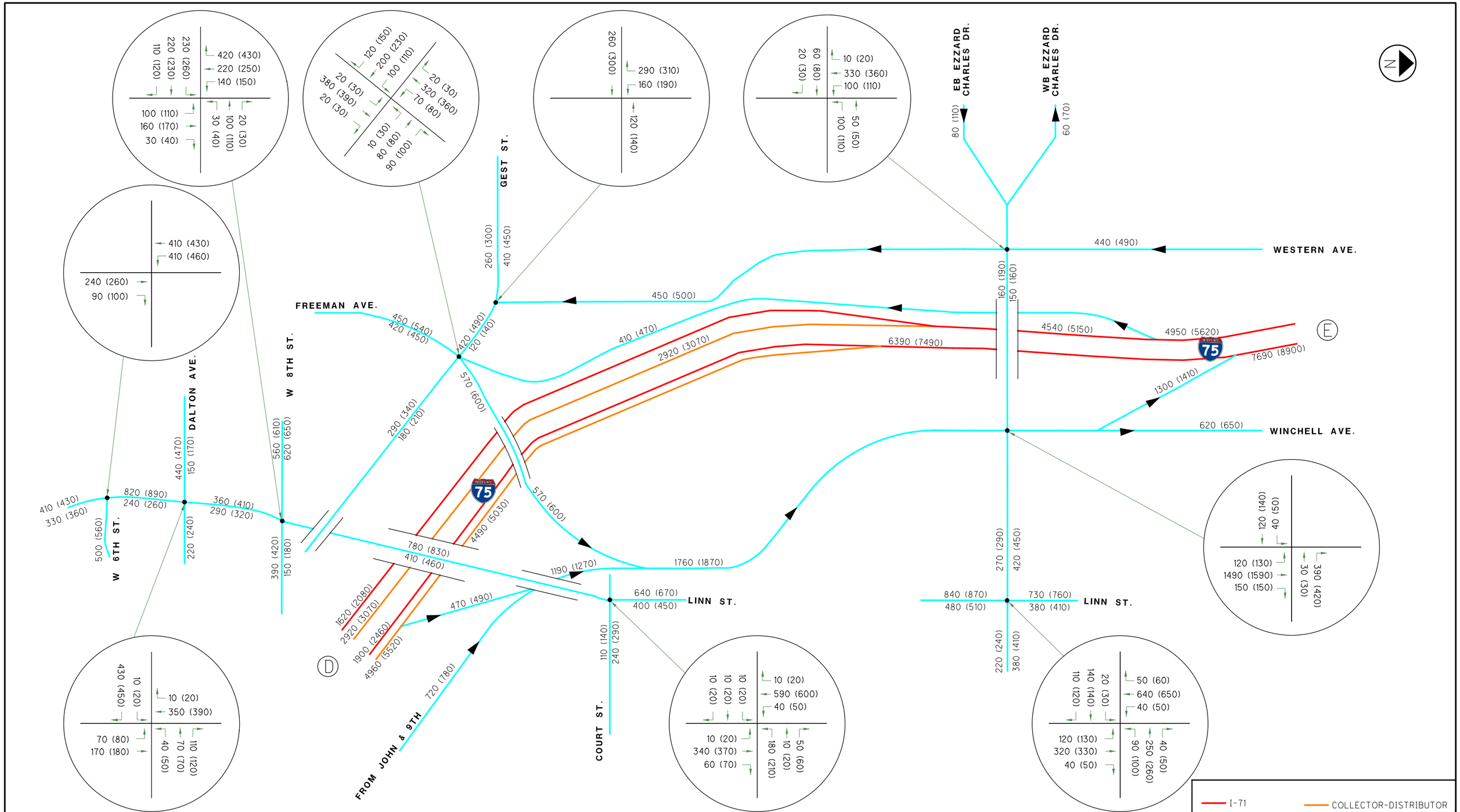
2029 & 2049 PM DHV TRAFFIC FORECASTS

PLATE 6 OF 10 (OH)

REFINED ALTERNATIVE I
(CONCEPT I-W)
INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB



LEGEND

XXX (XXX) = 2029 PM DHV (2049 PM DHV)

I-71
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

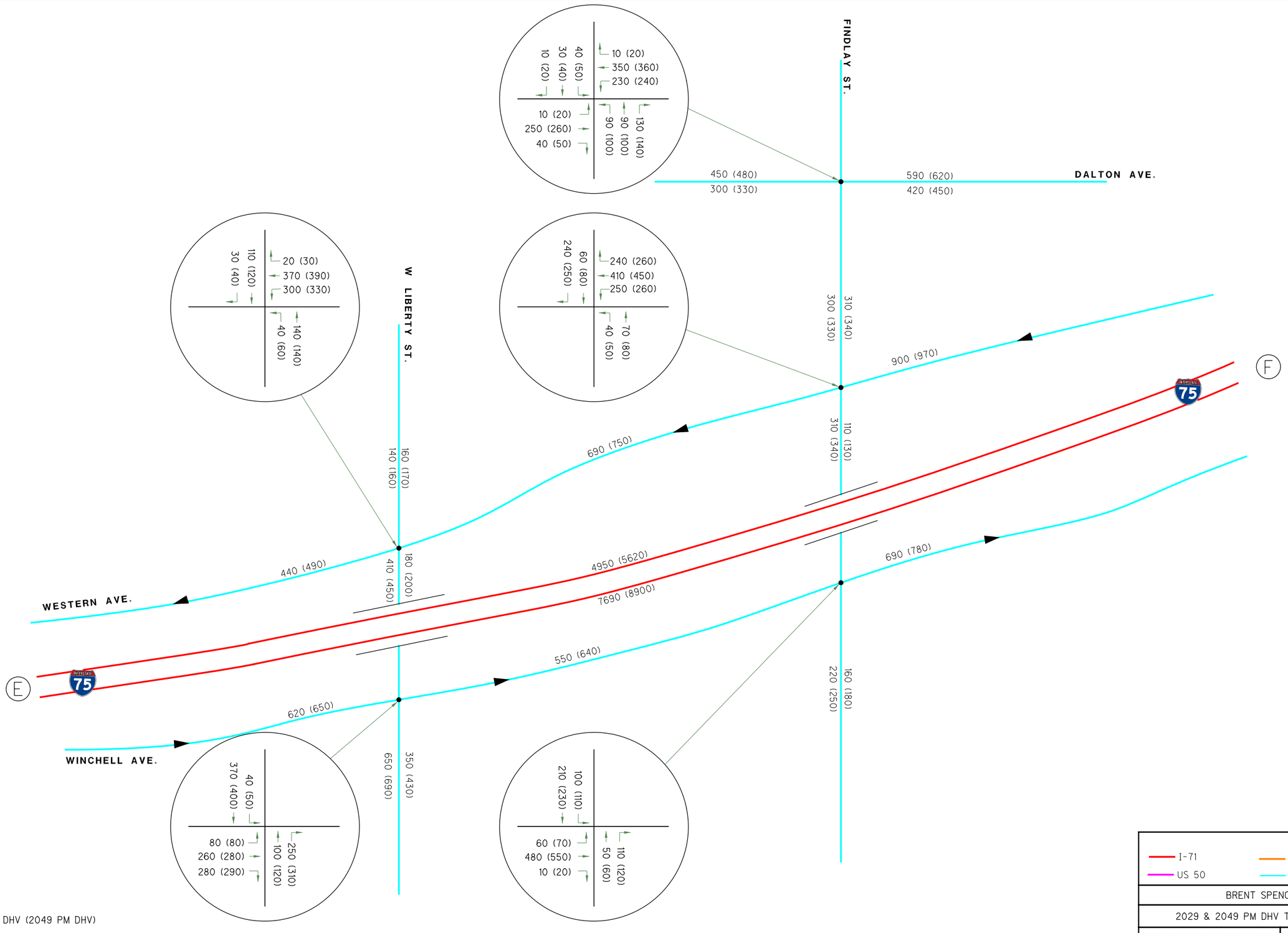
2029 & 2049 PM DHV TRAFFIC FORECASTS

PLATE 7 OF 10 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB



LEGEND

XXX (XXX) = 2029 PM DHV (2049 PM DHV)

I-71
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

2029 & 2049 PM DHV TRAFFIC FORECASTS

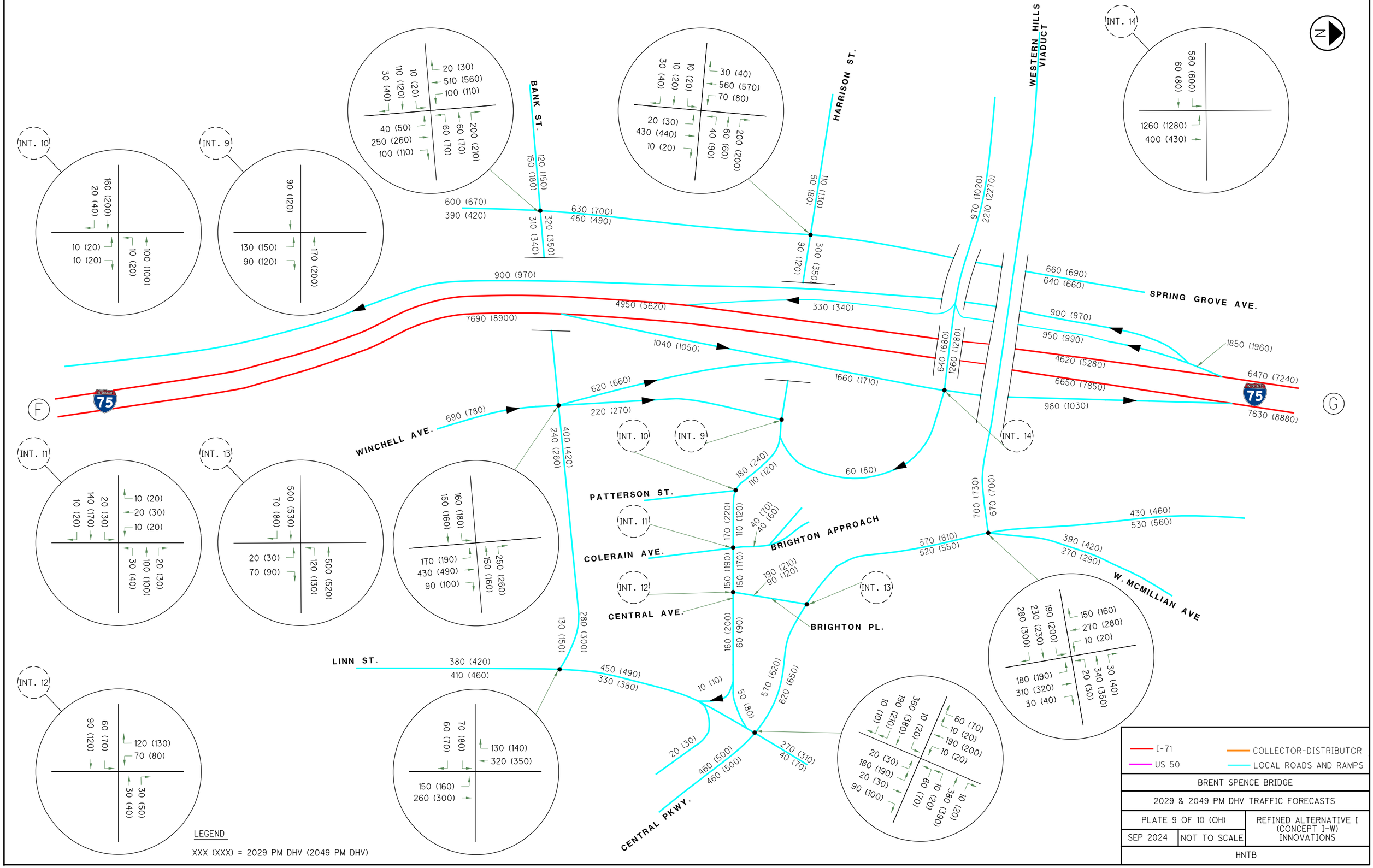
PLATE 8 OF 10 (OH)

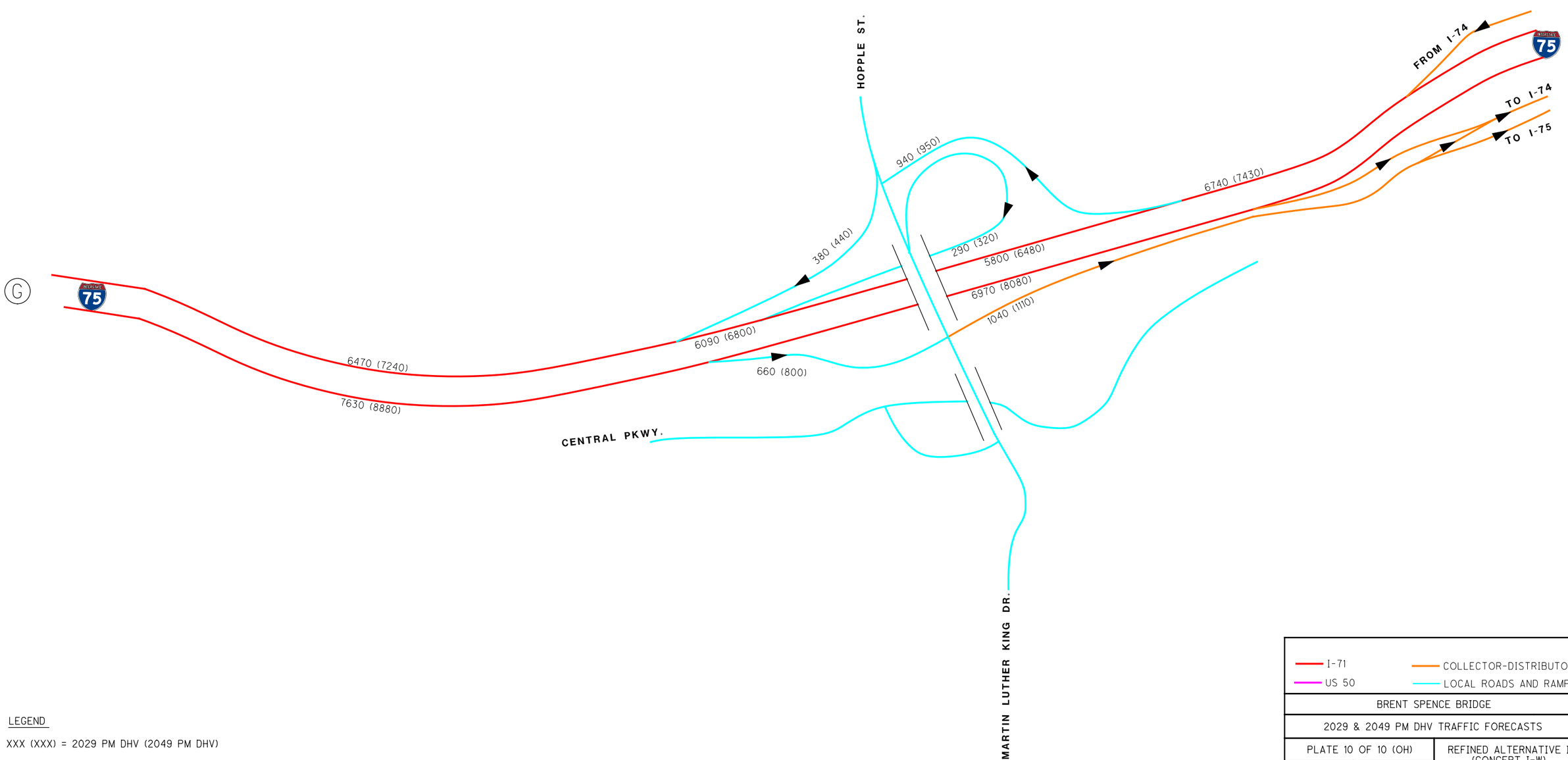
REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024

NOT TO SCALE

HNTB


BANK ST.
HARRISON ST.
WESTERN HILLS VIADUCT
SPRING GROVE AVE.
WINCHELL AVE.
PATTERSON ST.
COLERAIN AVE.
BRIGHTON APPROACH
CENTRAL AVE.
BRIGHTON PL.
W. MCMILLIAN AVE
LINN ST.
CENTRAL PKWY.
INT. 9
INT. 10
INT. 11
INT. 12
INT. 13
INT. 14
F
G
N
600 (670)
390 (420)
630 (700)
460 (490)
900 (970)
4950 (5620)
7690 (8900)
330 (340)
1040 (1050)
1660 (1710)
970 (1020)
2210 (2270)
660 (690)
640 (660)
900 (970)
950 (990)
1850 (1960)
4620 (5280)
6470 (7240)
6650 (7850)
980 (1030)
7630 (8880)
640 (680)
1260 (1280)
620 (660)
690 (780)
220 (270)
180 (240)
110 (120)
60 (80)
700 (730)
670 (700)
430 (460)
530 (560)
570 (610)
520 (550)
390 (420)
270 (290)
380 (420)
410 (460)
450 (490)
330 (380)
10 (10)
20 (30)
460 (500)
460 (500)
270 (310)
40 (70)
570 (620)
620 (650)
50 (80)
280 (300)
130 (150)
400 (420)
240 (260)
LEGEND
XXX (XXX) = 2029 PM DHV (2049 PM DHV)
I-71
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
BRENT SPENCE BRIDGE
2029 & 2049 PM DHV TRAFFIC FORECASTS
PLATE 9 OF 10 (OH)
REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS
SEP 2024
NOT TO SCALE
HNTB



LEGEND

XXX (XXX) = 2029 PM DHV (2049 PM DHV)

I-71
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

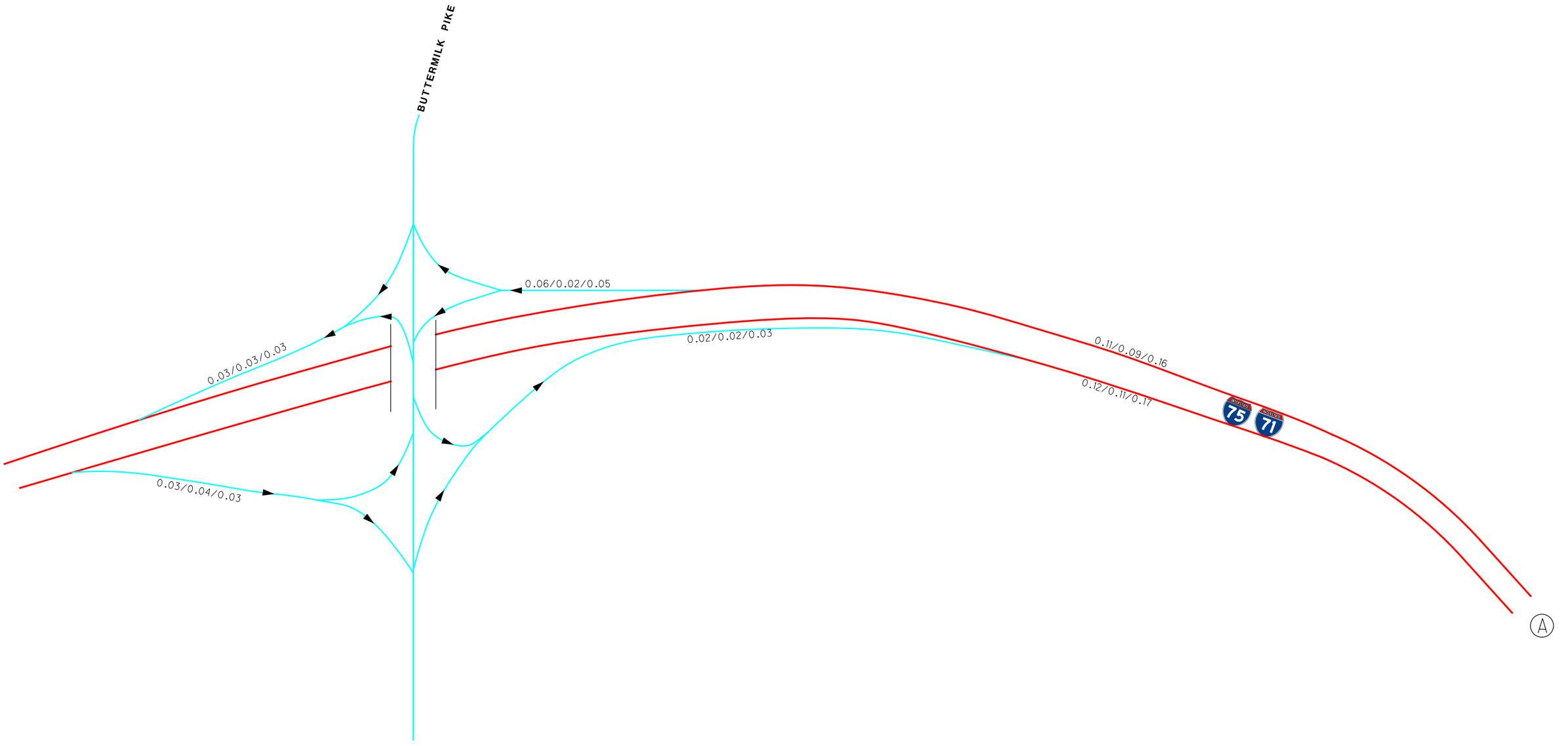
2029 & 2049 PM DHV TRAFFIC FORECASTS

PLATE 10 OF 10 (OH)		REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS
SEP 2024	NOT TO SCALE	

HNTB

NOTE

BUTTERMILK DDI CONFIGURATION IS NOT INCLUDED IN BRENT SPENCE BRIDGE PROJECT.



LEGEND

0.X / 0.X / 0.X = AM TD / PM TD / T24

I-71/I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

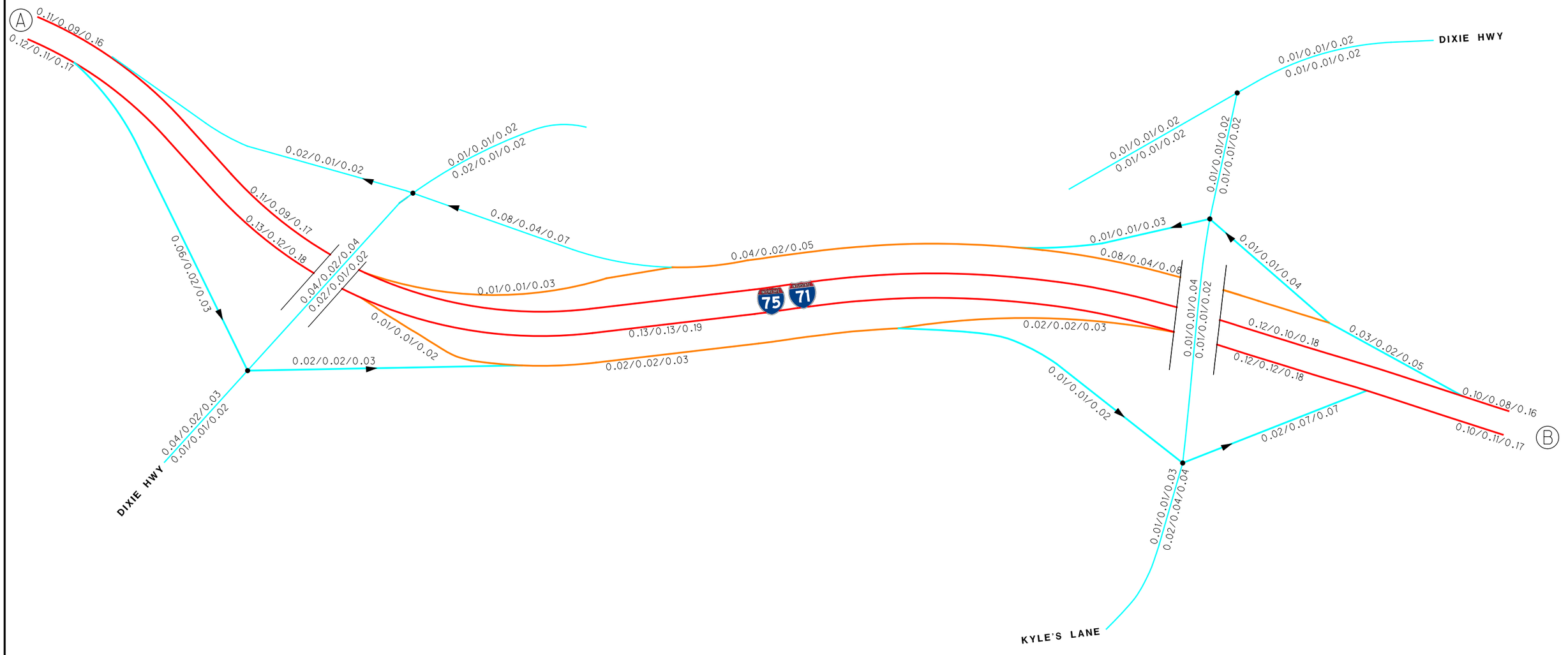
TRUCK FACTORS

PLATE 1 OF 10 (KY)

SEP 2024 | NOT TO SCALE

REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

HNTB



LEGEND

0.X / 0.X / 0.X = AM TD / PM TD / T24

I-71/I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

TRUCK FACTORS

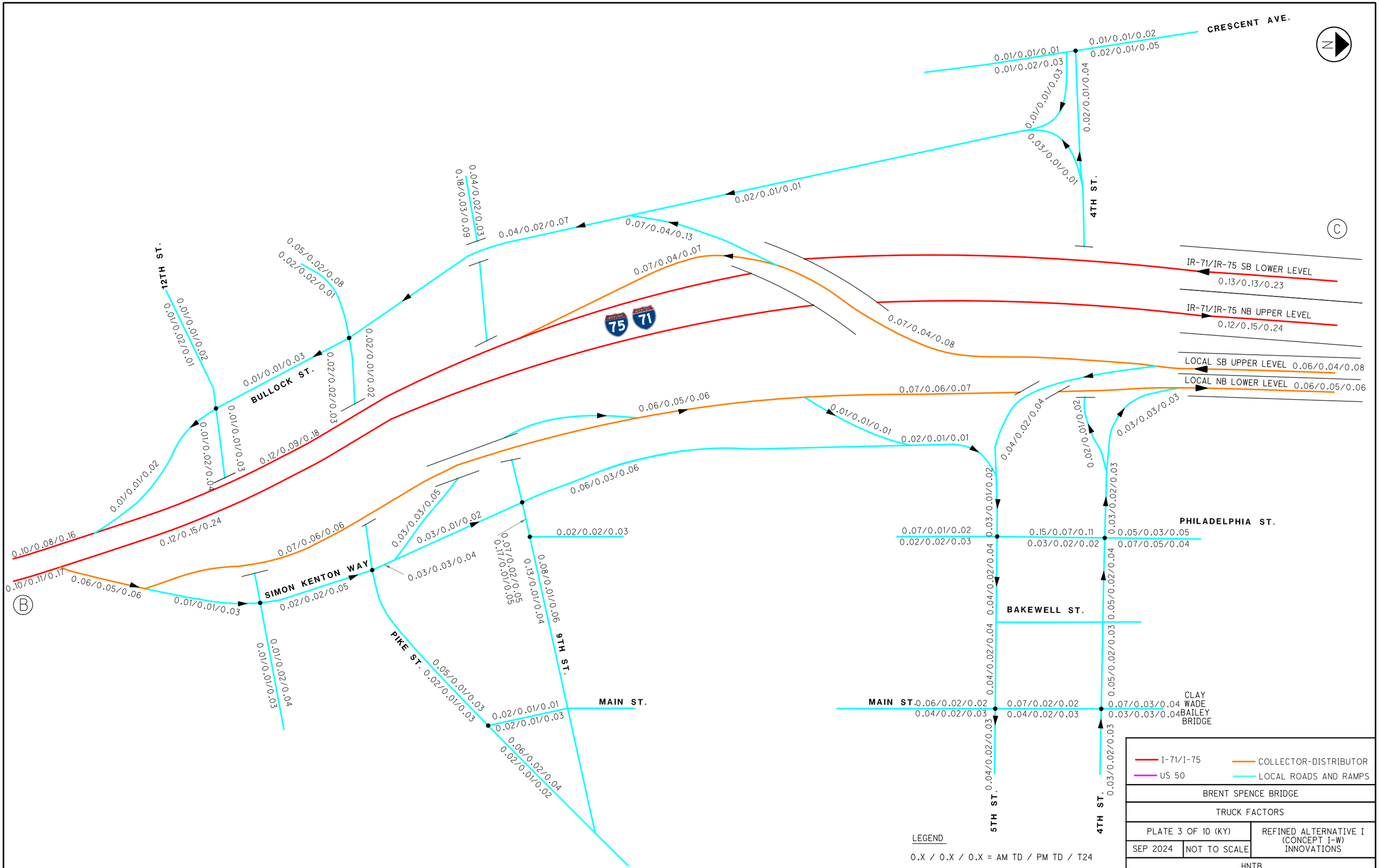
PLATE 2 OF 10 (KY)

REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024

NOT TO SCALE

HNTB



BRENT SPENCE BRIDGE

TRUCK FACTORS

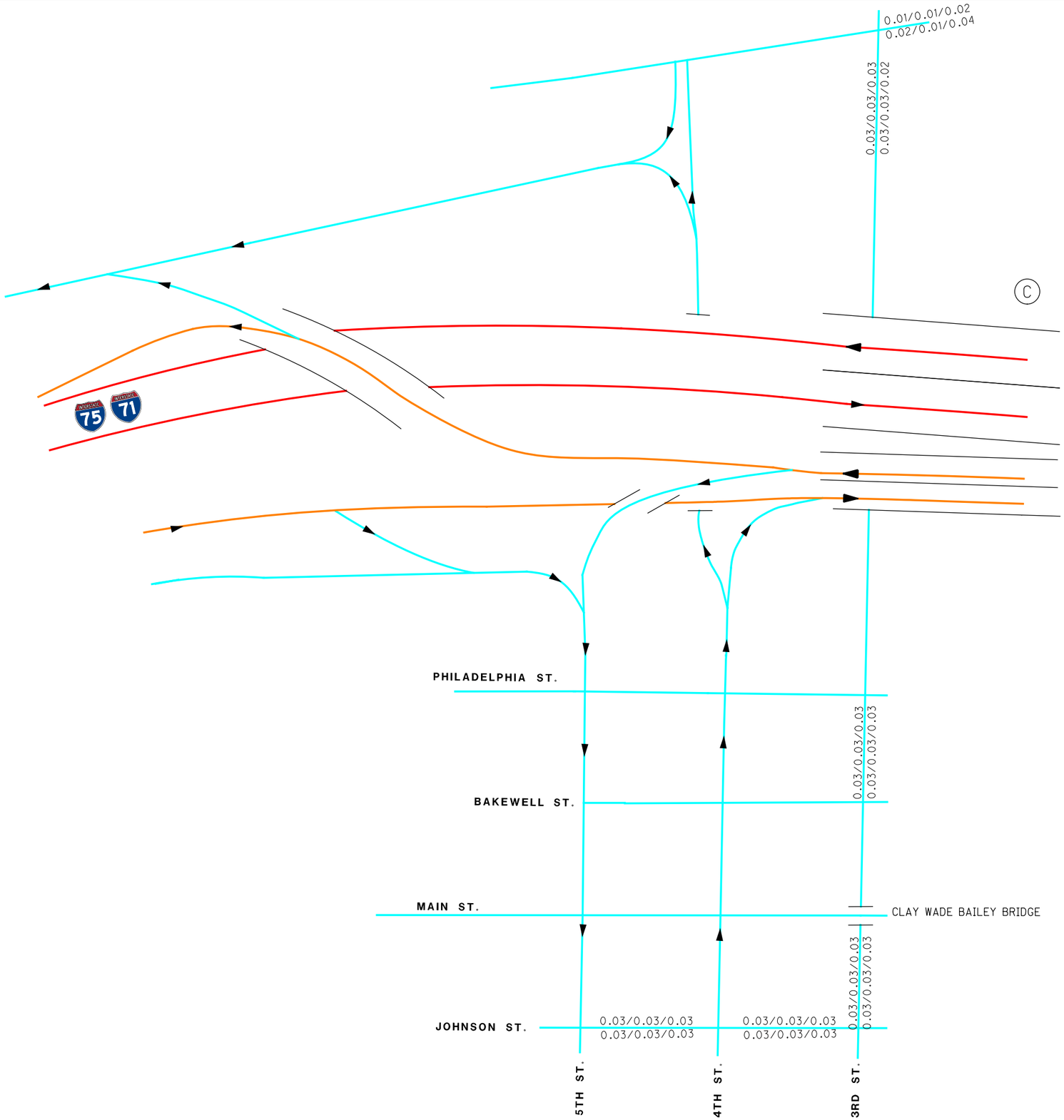
PLATE 3 OF 10 (KY)

REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB

SEE PLATE 3 FOR
ADDITIONAL VALUES



I-71/I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

TRUCK FACTORS

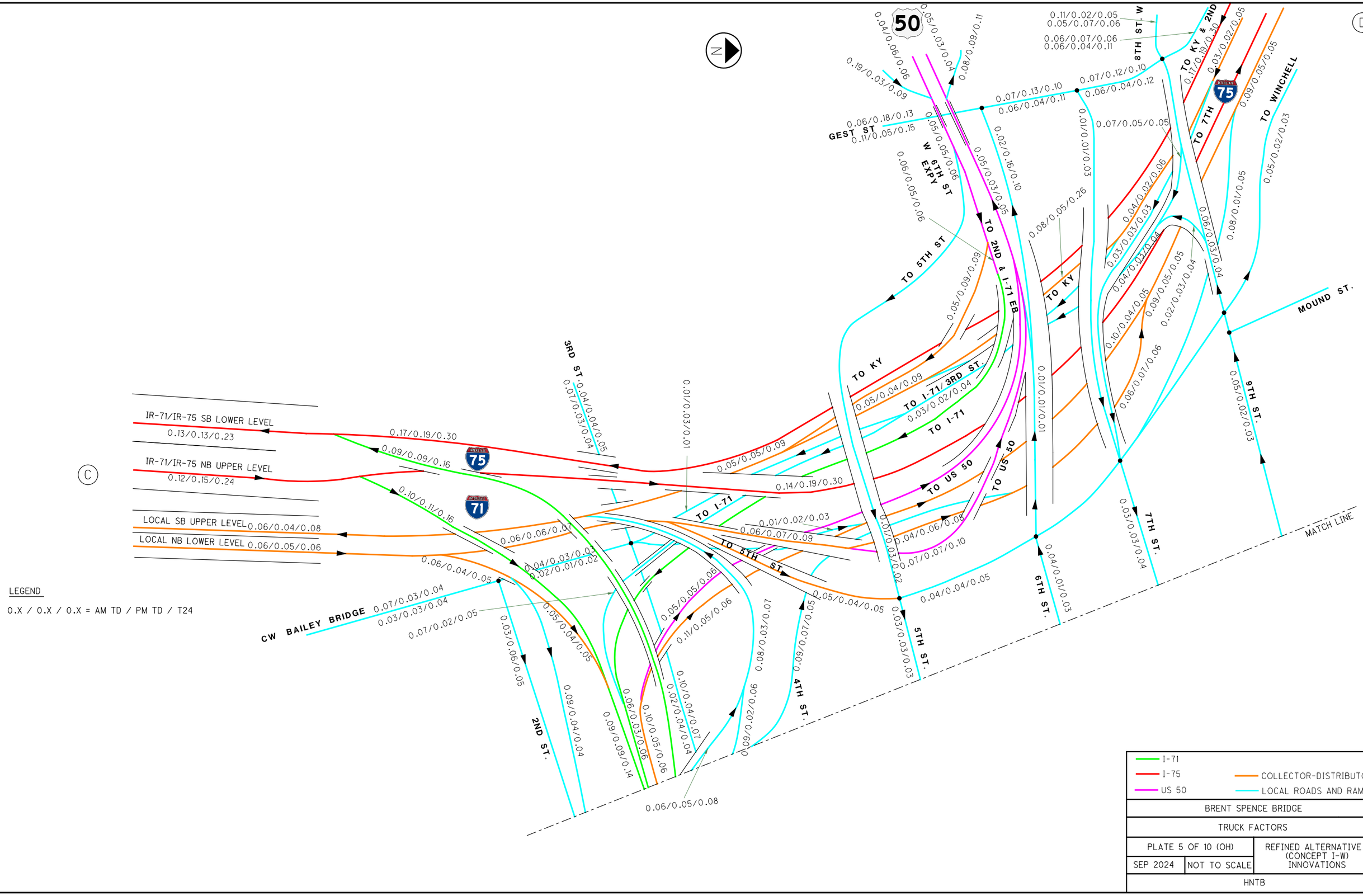
PLATE 4 OF 10 (KY)

REFINED ALTERNATIVE I
(CONCEPT I-W)
INNOVATIONS

SEP 2024

NOT TO SCALE

HNTB



BRENT SPENCE BRIDGE

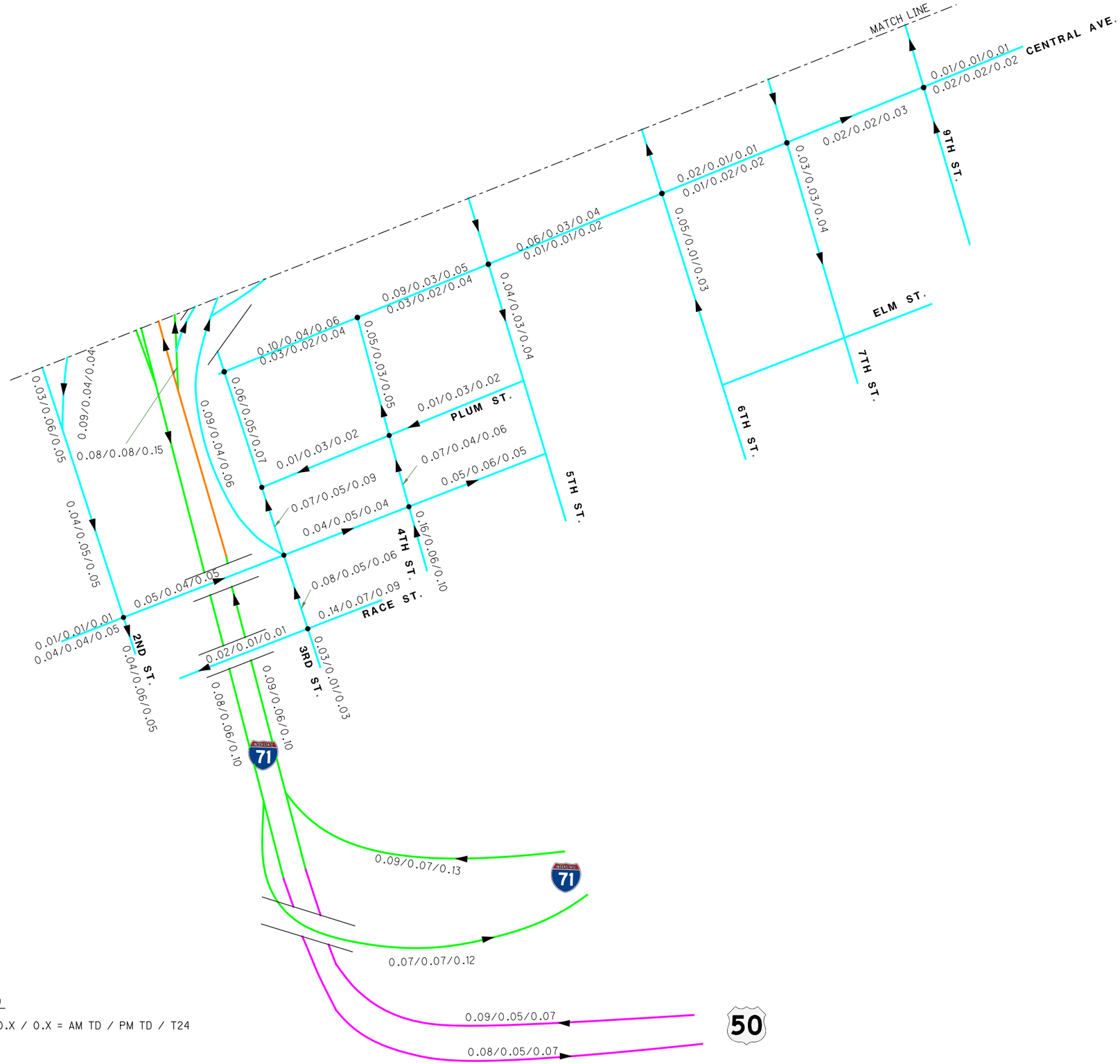
TRUCK FACTORS

PLATE 5 OF 10 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB



LEGEND

0.X / 0.X / 0.X = AM TD / PM TD / T24

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

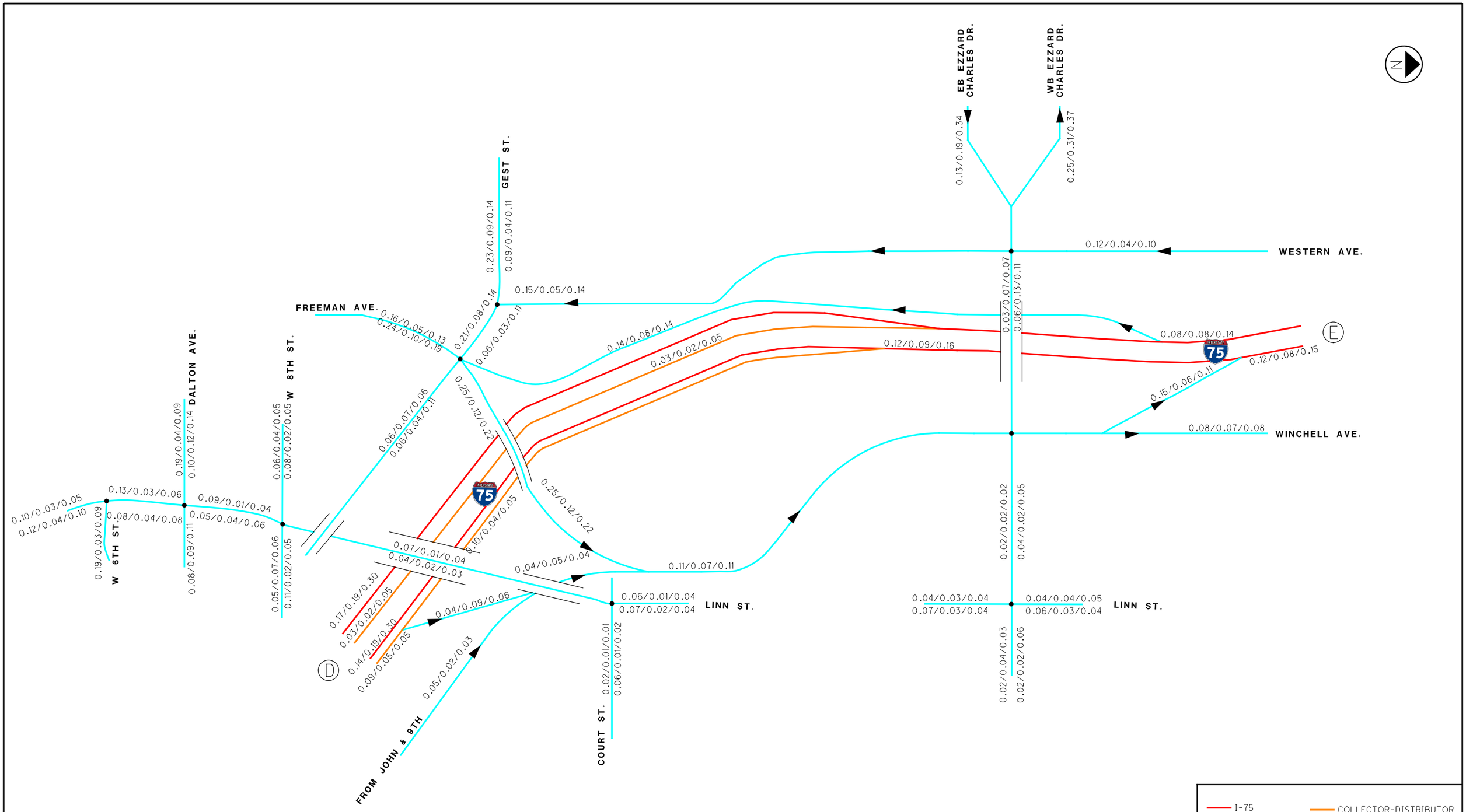
TRUCK FACTORS

PLATE 6 OF 10 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB



LEGEND

0.X / 0.X / 0.X = AM TD / PM TD / T24

I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

TRUCK FACTORS

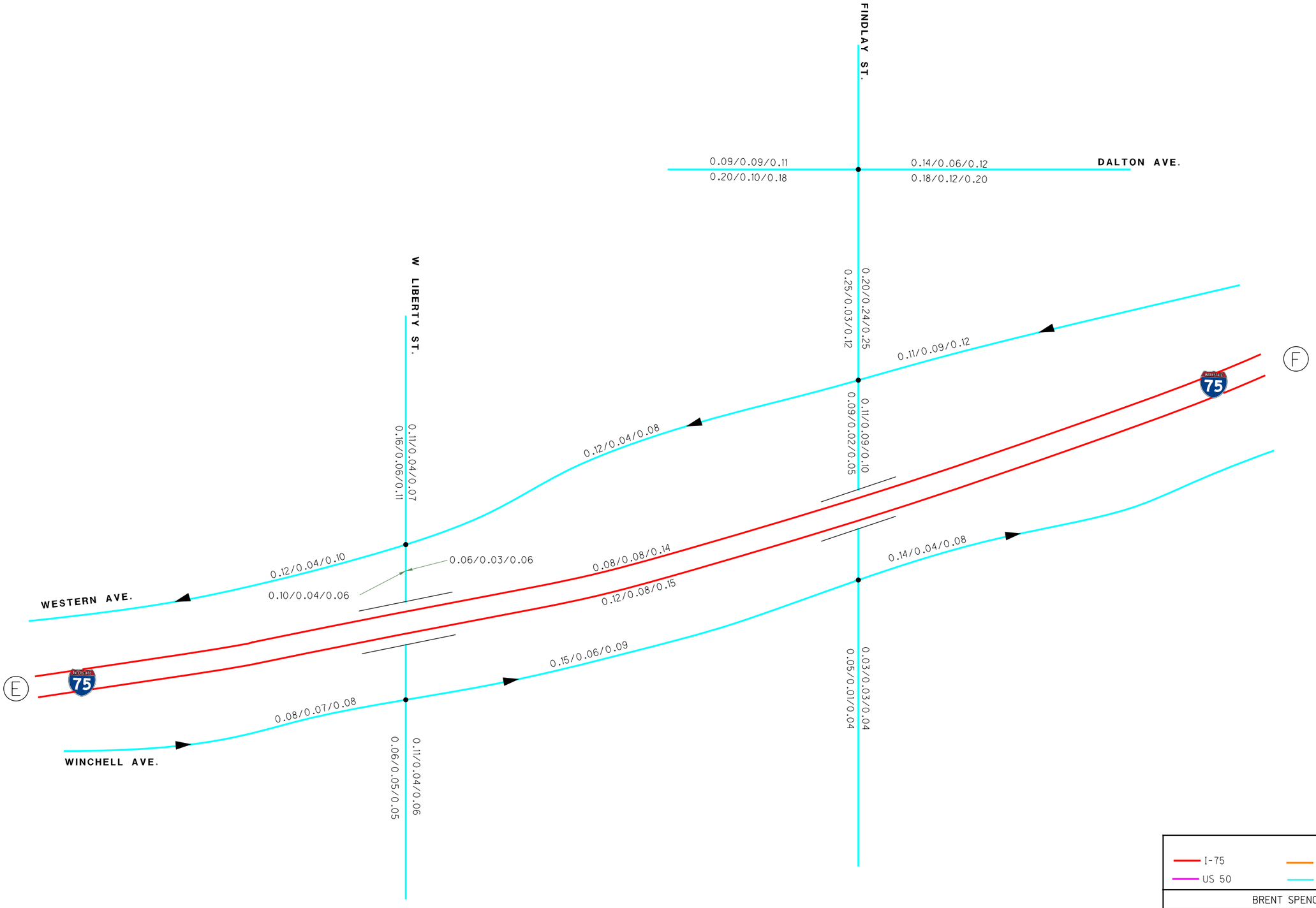
PLATE 7 OF 10 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

SEP 2024

NOT TO SCALE

HNTB



LEGEND

0.X / 0.X / 0.X = AM TD / PM TD / T24

I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

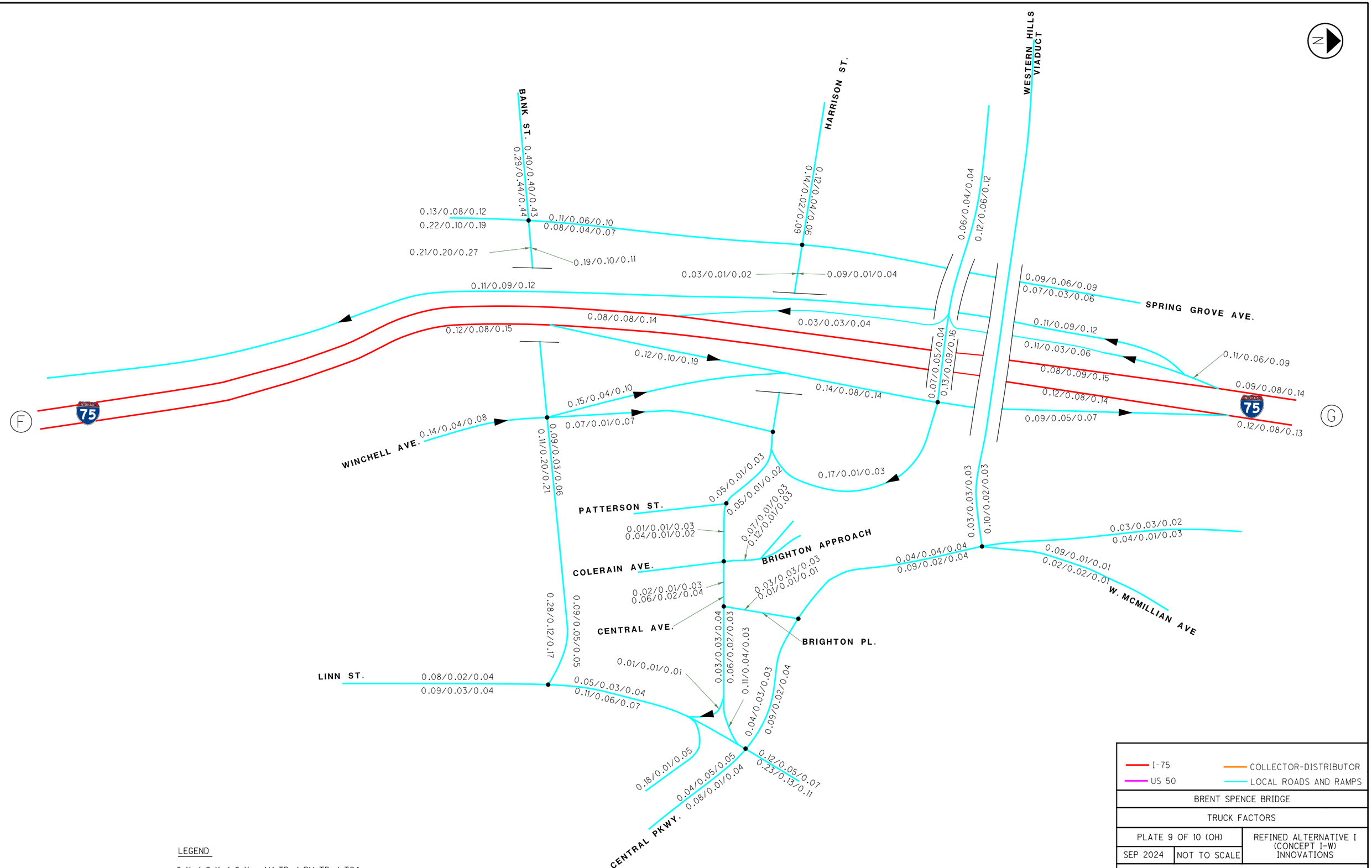
TRUCK FACTORS

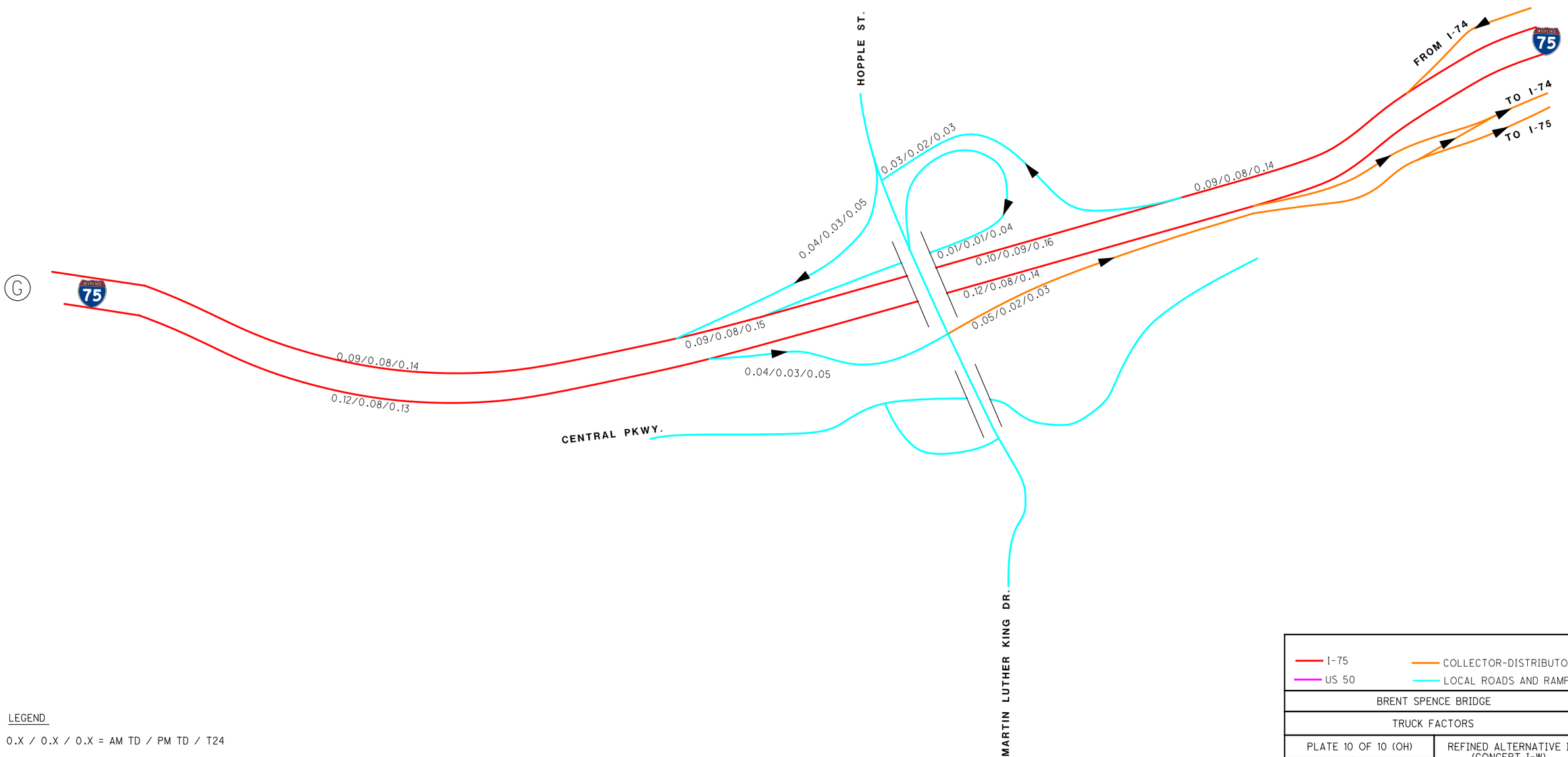
PLATE 8 OF 10 (OH)

REFINED ALTERNATIVE I
(CONCEPT I-W)
INNOVATIONS

SEP 2024 | NOT TO SCALE

HNTB


N
F
G
I-75
BANK ST.
HARRISON ST.
WESTERN HILLS VIADUCT
SPRING GROVE AVE.
WINCHELL AVE.
PATTERSON ST.
COLERAIN AVE.
CENTRAL AVE.
LINN ST.
BRIGHTON APPROACH
BRIGHTON PL.
W. MCMILLIAN AVE
CENTRAL PKWY.
0.13/0.08/0.12
0.22/0.10/0.19
0.29/0.44/0.44
0.40/0.40/0.43
0.11/0.06/0.10
0.08/0.04/0.07
0.21/0.20/0.27
0.19/0.10/0.11
0.14/0.04/0.09
0.12/0.02/0.09
0.03/0.01/0.02
0.09/0.01/0.04
0.06/0.04/0.04
0.12/0.06/0.12
0.11/0.09/0.12
0.12/0.08/0.15
0.08/0.08/0.14
0.03/0.03/0.04
0.12/0.10/0.19
0.14/0.08/0.14
0.07/0.05/0.04
0.13/0.09/0.16
0.09/0.06/0.09
0.07/0.03/0.06
0.11/0.09/0.12
0.11/0.03/0.06
0.11/0.06/0.09
0.08/0.09/0.15
0.09/0.08/0.14
0.12/0.08/0.14
0.09/0.05/0.07
0.12/0.08/0.13
0.14/0.04/0.08
0.15/0.04/0.10
0.07/0.01/0.07
0.11/0.20/0.21
0.09/0.03/0.06
0.17/0.01/0.03
0.05/0.01/0.03
0.05/0.01/0.02
0.07/0.01/0.03
0.12/0.01/0.03
0.01/0.01/0.03
0.04/0.01/0.02
0.02/0.01/0.03
0.06/0.02/0.04
0.03/0.03/0.03
0.01/0.01/0.01
0.03/0.03/0.03
0.10/0.02/0.03
0.03/0.03/0.02
0.04/0.01/0.03
0.04/0.04/0.04
0.09/0.02/0.04
0.09/0.01/0.01
0.02/0.02/0.01
0.28/0.12/0.17
0.09/0.05/0.05
0.08/0.02/0.04
0.09/0.03/0.04
0.01/0.01/0.01
0.05/0.03/0.04
0.11/0.06/0.07
0.03/0.03/0.04
0.06/0.02/0.03
0.11/0.04/0.03
0.04/0.03/0.03
0.09/0.02/0.04
0.18/0.01/0.05
0.04/0.05/0.05
0.08/0.01/0.04
0.12/0.05/0.07
0.23/0.13/0.11
LEGEND
0.X / 0.X / 0.X = AM TD / PM TD / T24
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
BRENT SPENCE BRIDGE
TRUCK FACTORS
PLATE 9 OF 10 (OH)
REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS
SEP 2024
NOT TO SCALE
HNTB



LEGEND

0.X / 0.X / 0.X = AM TD / PM TD / T24

I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

TRUCK FACTORS

PLATE 10 OF 10 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W) INNOVATIONS

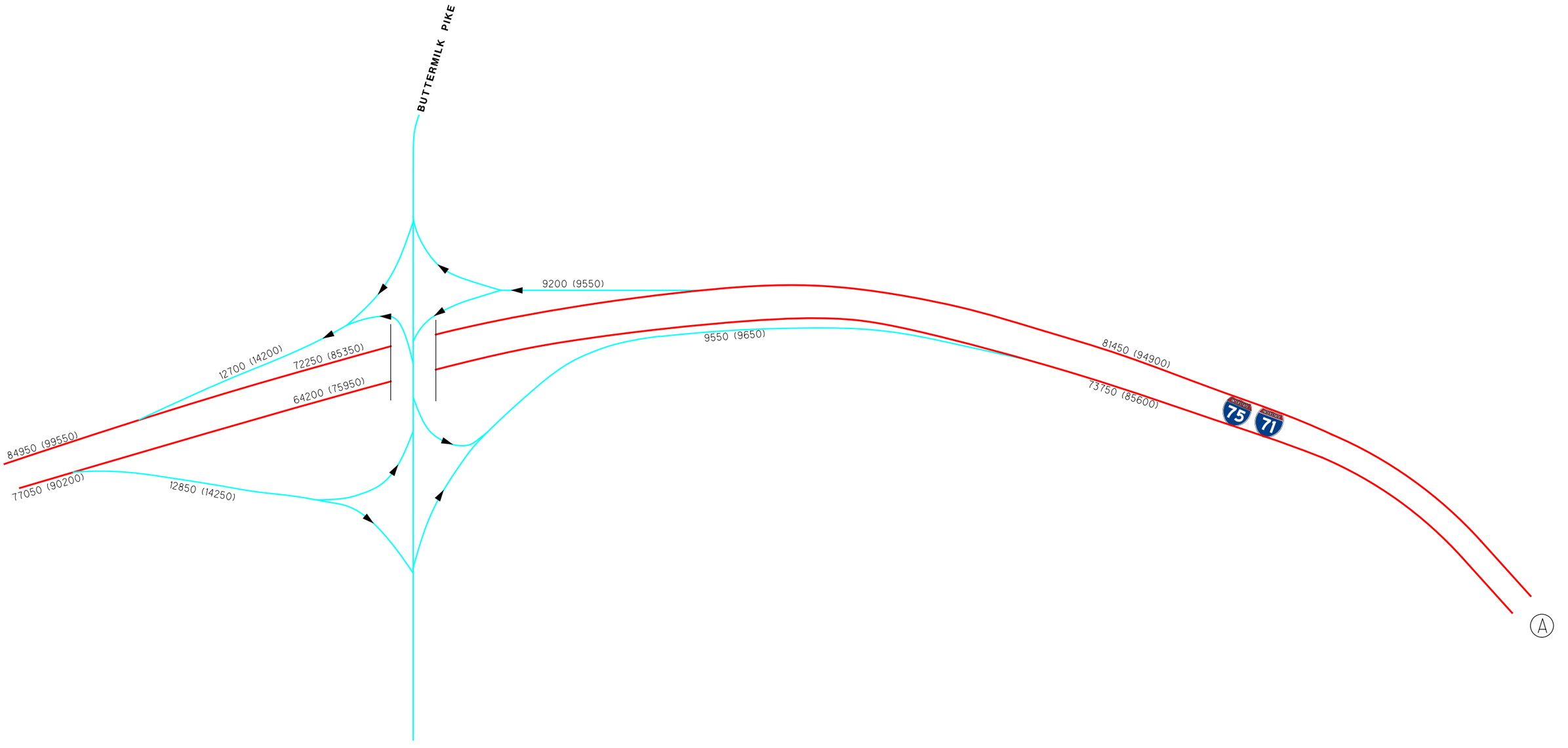
SEP 2024 | NOT TO SCALE

HNTB

Appendix E-3:
Refined Alternative I (Concept I-W) Certified Traffic

NOTE

BUTTERMILK DDI CONFIGURATION IS NOT INCLUDED IN BRENT SPENCE BRIDGE PROJECT.

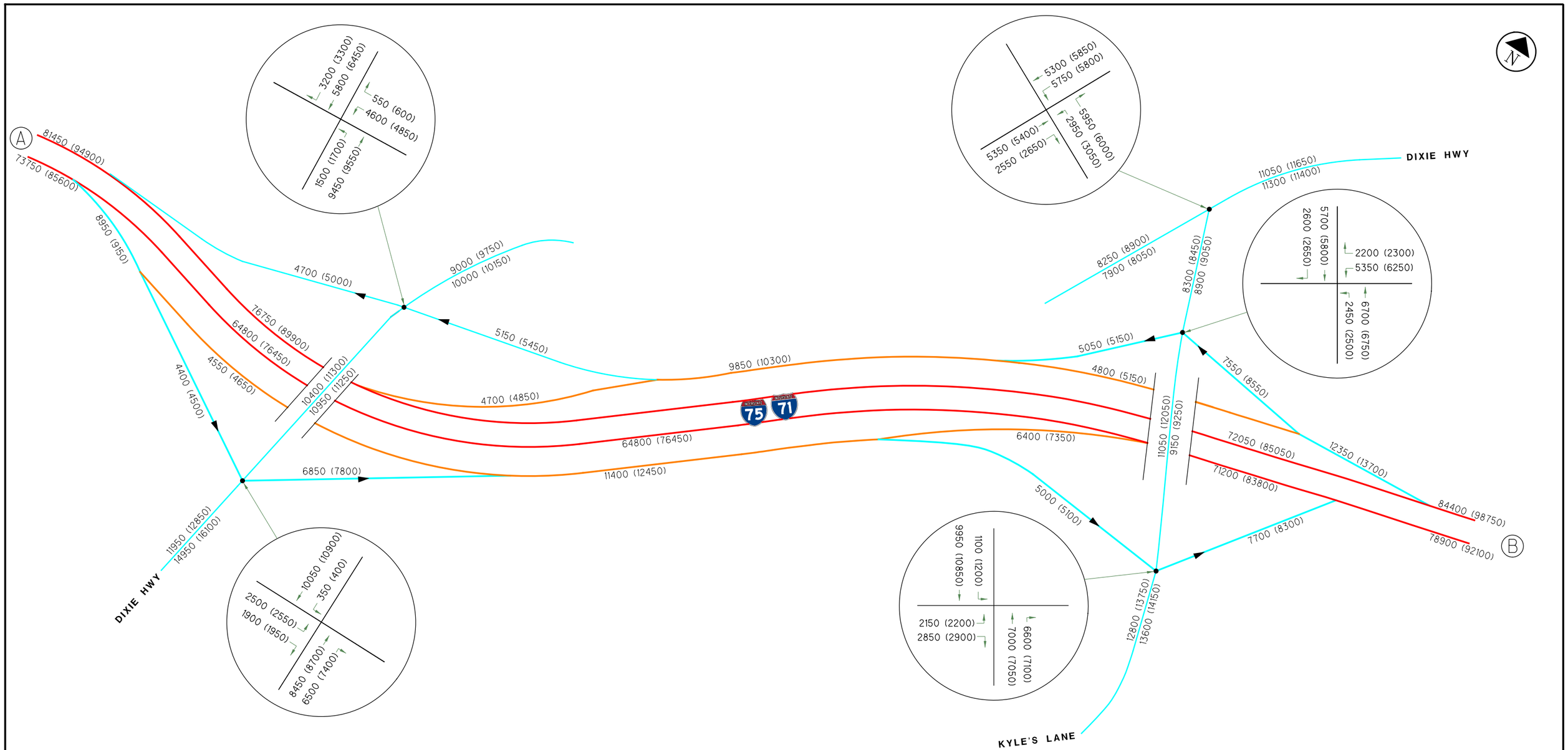


LEGEND

XXX (XXX) = 2029 AADT (2049 AADT)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE		
2029 & 2049 DAILY TRAFFIC FORECASTS		
PLATE 1 OF 12 (KY)		REFINED ALTERNATIVE I (CONCEPT I-W)
MAY 2023	NOT TO SCALE	
HNTB		



LEGEND

XXX (XXX) = 2029 AADT (2049 AADT)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

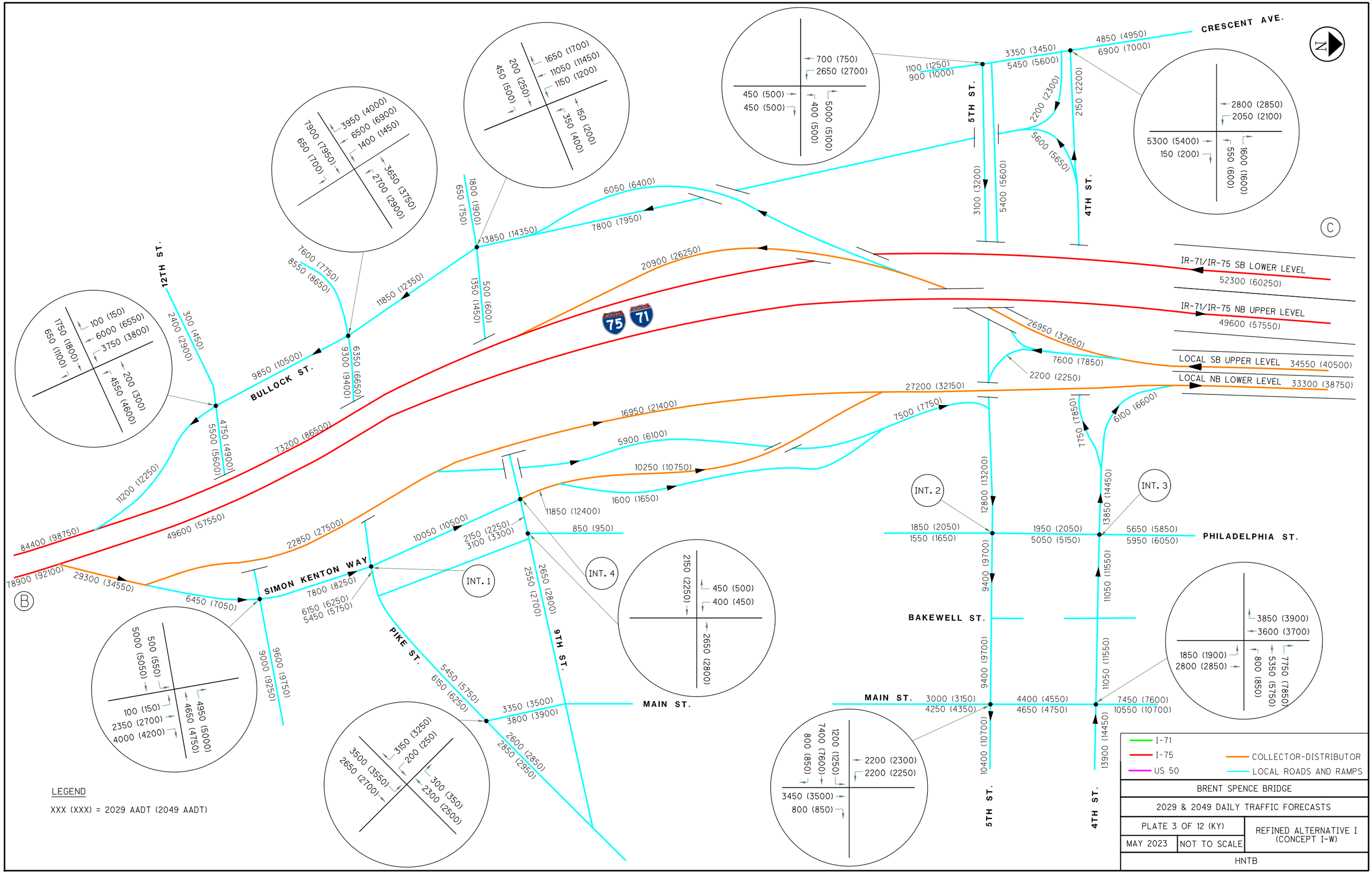
2029 & 2049 DAILY TRAFFIC FORECASTS

PLATE 2 OF 12 (KY)

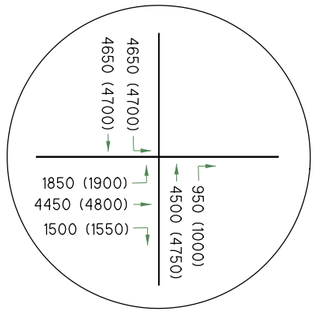
REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB

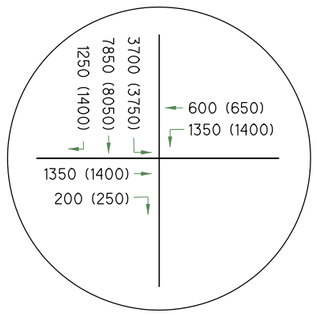

CRESCENT AVE.
5TH ST.
4TH ST.
12TH ST.
BULLOCK ST.
SIMON KENTON WAY
PIKE ST.
9TH ST.
MAIN ST.
BAKEWELL ST.
PHILADELPHIA ST.
INT. 1
INT. 2
INT. 3
INT. 4
IR-71/IR-75 SB LOWER LEVEL
52300 (60250)
IR-71/IR-75 NB UPPER LEVEL
49600 (57550)
LOCAL SB UPPER LEVEL 34550 (40500)
LOCAL NB LOWER LEVEL 33300 (38750)
LEGEND
XXX (XXX) = 2029 AADT (2049 AADT)
I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
BRENT SPENCE BRIDGE
2029 & 2049 DAILY TRAFFIC FORECASTS
PLATE 3 OF 12 (KY)
REFINED ALTERNATIVE I (CONCEPT I-W)
MAY 2023
NOT TO SCALE
HNTB

INT. 1



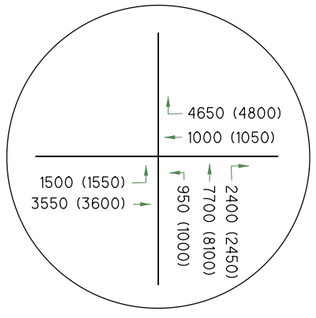
SIMON KENTON WAY & PIKE STREET

INT. 2



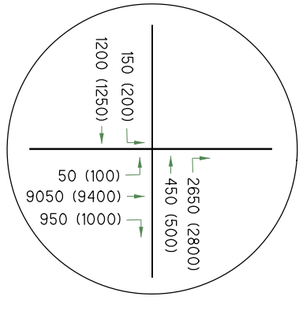
5TH STREET & PHILADELPHIA STREET

INT. 3



4TH STREET & PHILADELPHIA STREET

INT. 4



SIMON KENTON WAY & 9TH STREET

LEGEND

XXX (XXX) = 2029 AADT (2049 AADT)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

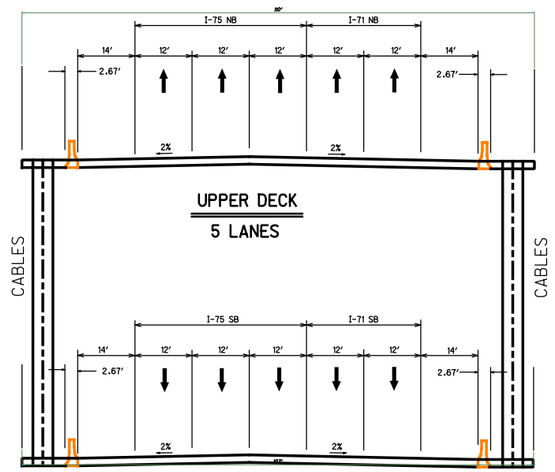
2029 & 2049 DAILY TRAFFIC FORECASTS

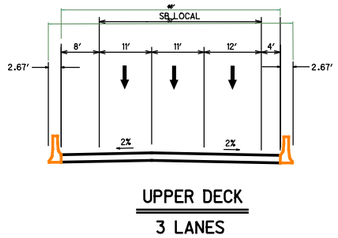
PLATE 4 OF 12 (KY)

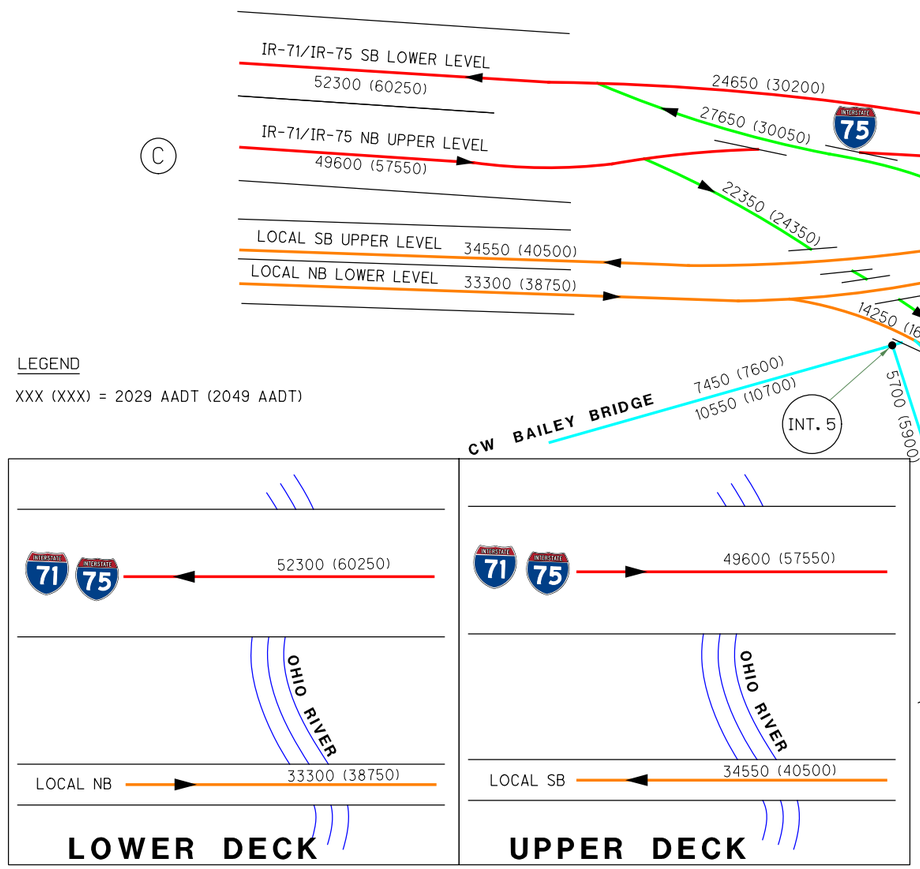
REFINED ALTERNATIVE I
(CONCEPT I-W)

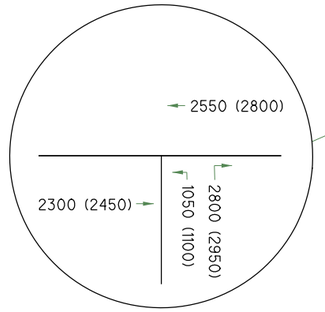
MAY 2023 | NOT TO SCALE

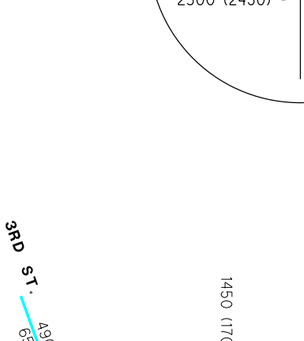
HNTB

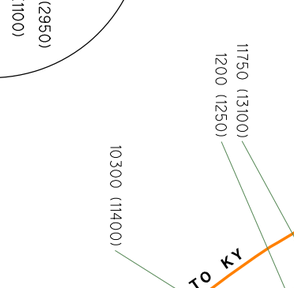


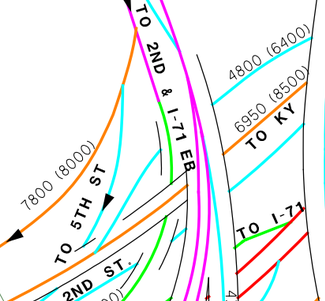


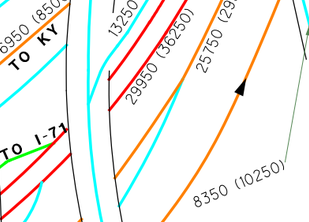


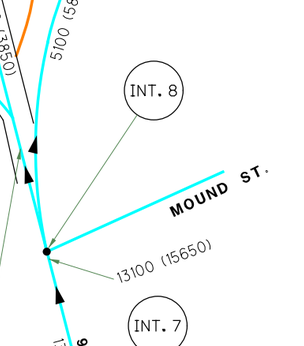












I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

2029 & 2049 DAILY TRAFFIC FORECASTS

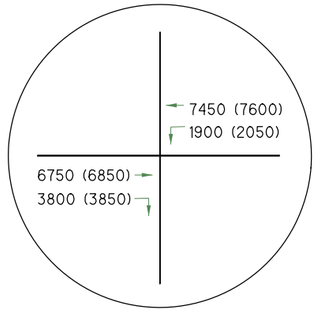
PLATE 5 OF 12 (OH)

MAY 2023 | NOT TO SCALE

REFINED ALTERNATIVE I (CONCEPT I-W)

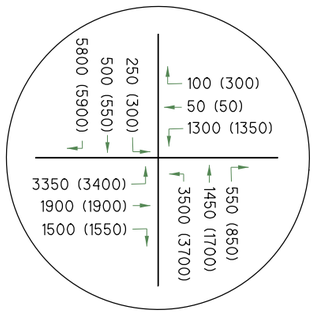
HNTB

INT. 5



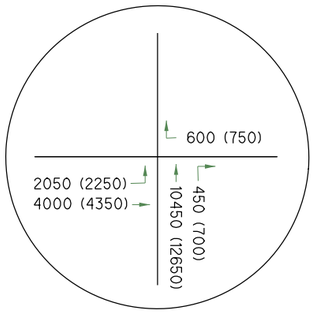
CW BAILEY BRIDGE & 2ND STREET

INT. 6



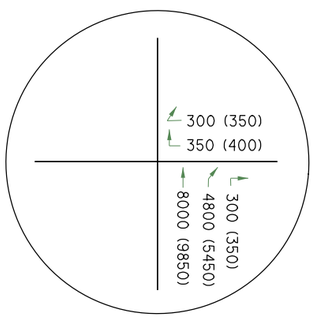
CW BAILEY BRIDGE & 3RD STREET

INT. 7



CENTRAL AVENUE & 9TH STREET

INT. 8



MOUND STREET & 9TH STREET

LEGEND

XXX (XXX) = 2029 AADT (2049 AADT)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

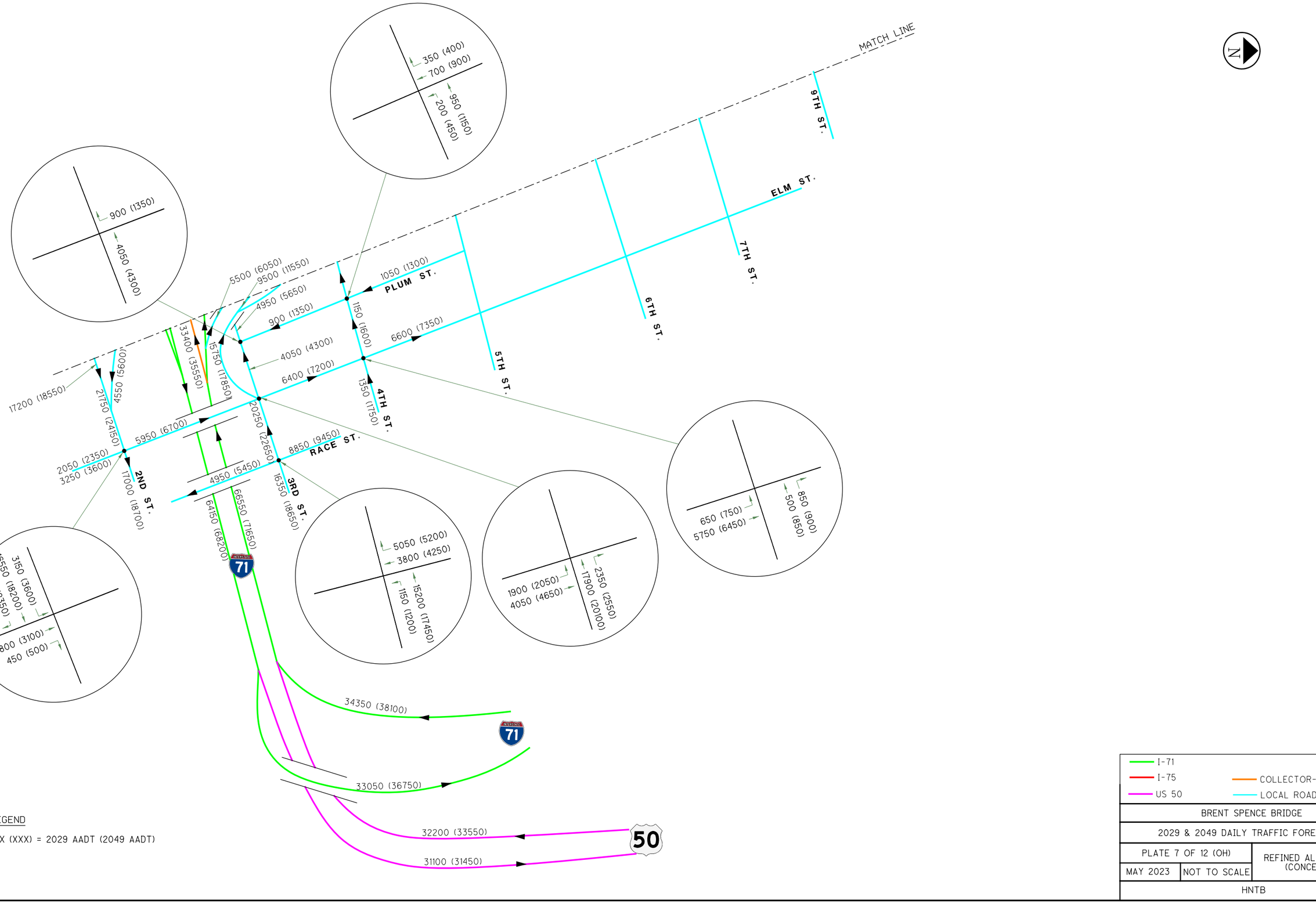
2029 & 2049 DAILY TRAFFIC FORECASTS

PLATE 6 OF 12 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB



I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

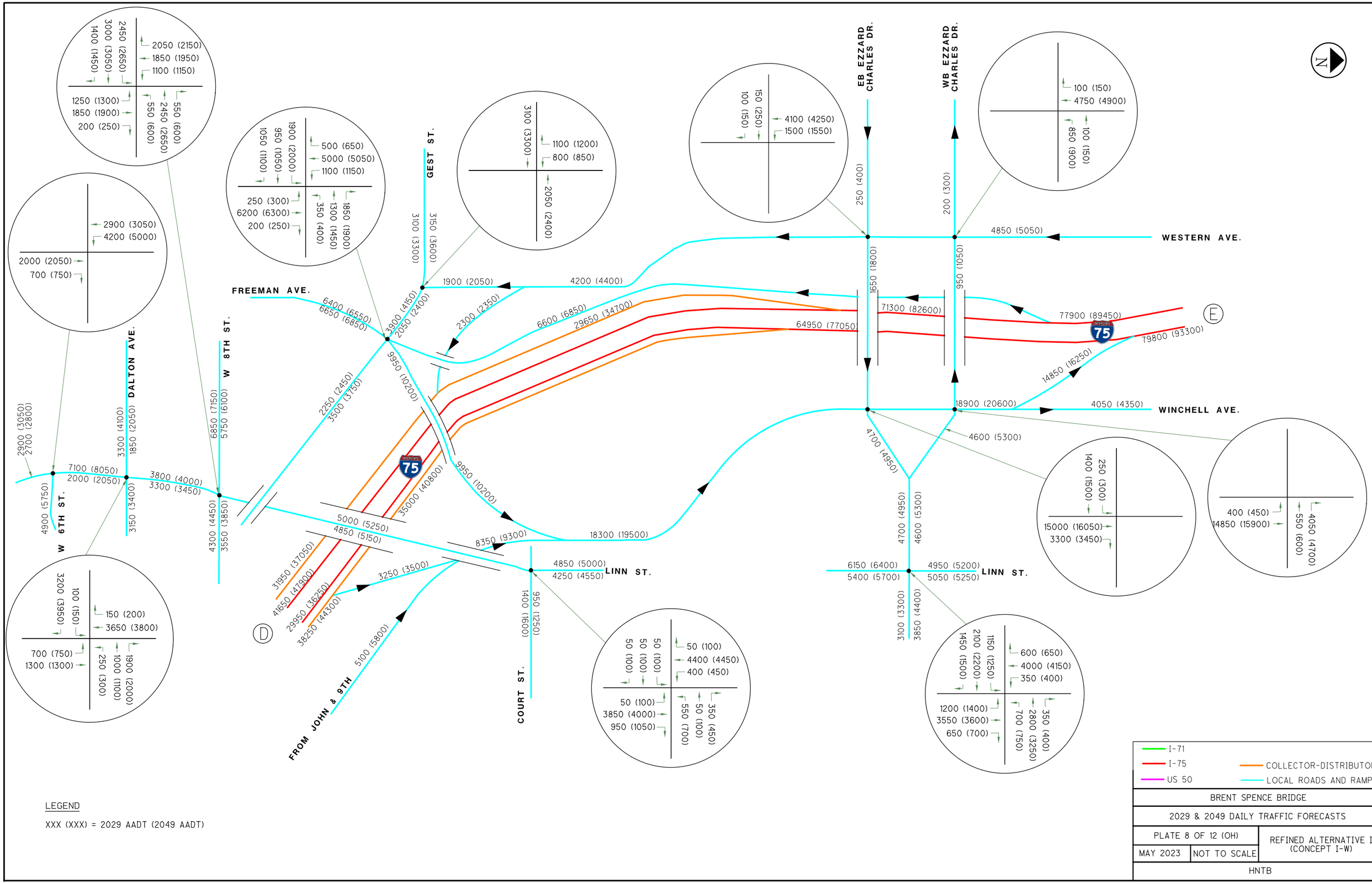
2029 & 2049 DAILY TRAFFIC FORECASTS

PLATE 7 OF 12 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB



LEGEND

XXX (XXX) = 2029 AADT (2049 AADT)

BRENT SPENCE BRIDGE

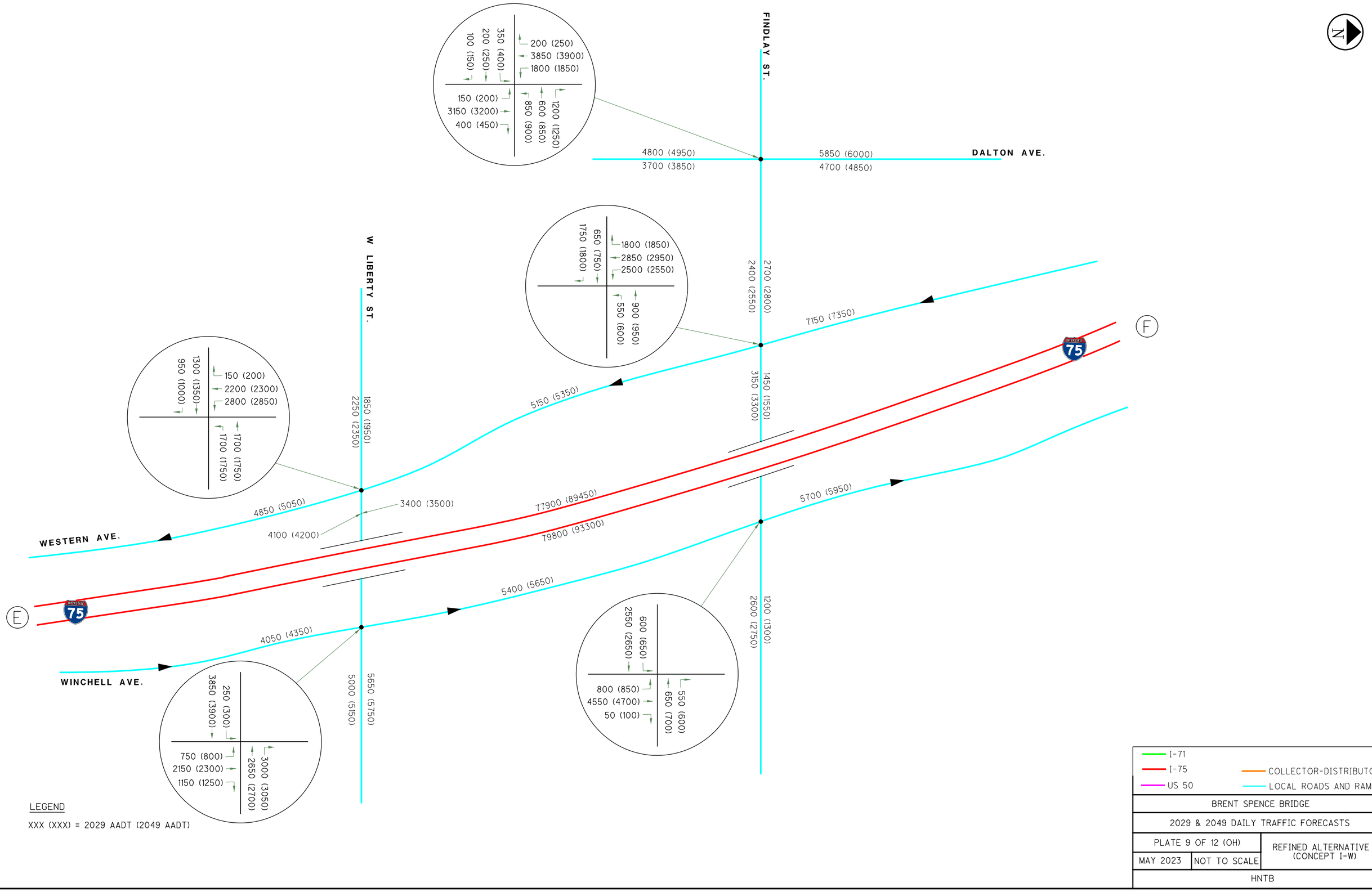
2029 & 2049 DAILY TRAFFIC FORECASTS

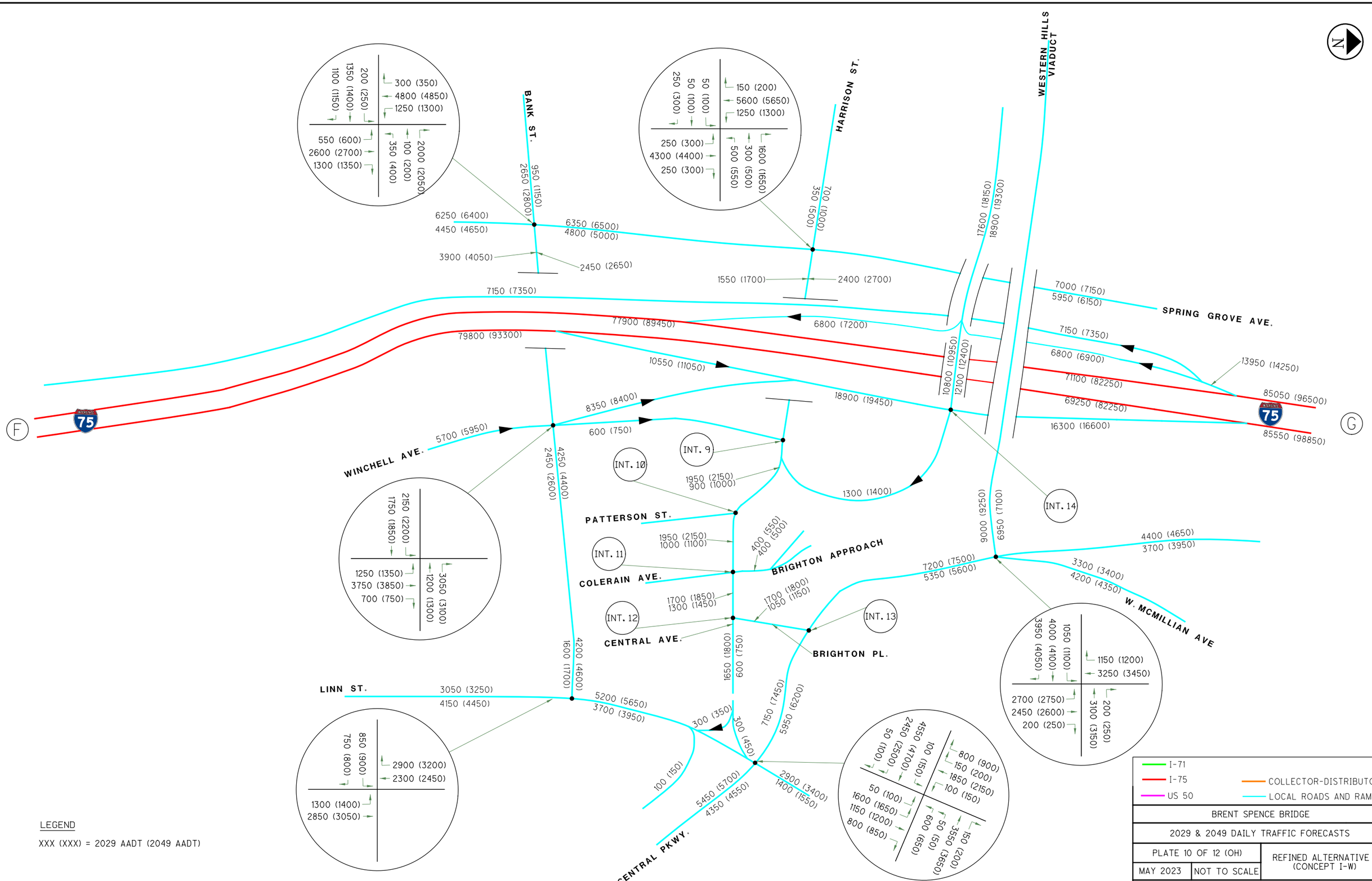
PLATE 8 OF 12 (OH)

MAY 2023 | NOT TO SCALE

REFINED ALTERNATIVE I (CONCEPT I-W)

HNTB


FINDLAY ST.
DALTON AVE.
W LIBERTY ST.
WESTERN AVE.
WINCHELL AVE.
INTERSTATE 75
E
F
N
200 (250)
3850 (3900)
1800 (1850)
350 (400)
200 (250)
100 (150)
150 (200)
3150 (3200)
400 (450)
850 (900)
600 (850)
1200 (1250)
4800 (4950)
3700 (3850)
5850 (6000)
4700 (4850)
1800 (1850)
2850 (2950)
2500 (2550)
1750 (1800)
650 (750)
550 (600)
900 (950)
2700 (2800)
2400 (2550)
7150 (7350)
1450 (1550)
3150 (3300)
5150 (5350)
150 (200)
2200 (2300)
2800 (2850)
1300 (1350)
950 (1000)
1700 (1750)
1700 (1750)
1850 (1950)
2250 (2350)
4850 (5050)
3400 (3500)
4100 (4200)
77900 (89450)
79800 (93300)
5700 (5950)
5400 (5650)
4050 (4350)
2550 (2650)
600 (650)
800 (850)
4550 (4700)
50 (100)
650 (700)
550 (600)
1200 (1300)
2600 (2750)
3850 (3900)
250 (300)
750 (800)
2150 (2300)
1150 (1250)
2650 (2700)
3000 (3050)
5000 (5150)
5650 (5750)
LEGEND
XXX (XXX) = 2029 AADT (2049 AADT)
I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
BRENT SPENCE BRIDGE
2029 & 2049 DAILY TRAFFIC FORECASTS
PLATE 9 OF 12 (OH)
REFINED ALTERNATIVE I
(CONCEPT I-W)
MAY 2023
NOT TO SCALE
HNTB



LEGEND

XXX (XXX) = 2029 AADT (2049 AADT)

BRENT SPENCE BRIDGE

2029 & 2049 DAILY TRAFFIC FORECASTS

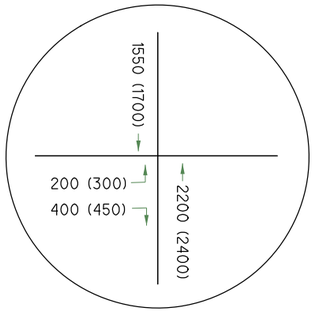
PLATE 10 OF 12 (OH)

MAY 2023 | NOT TO SCALE

REFINED ALTERNATIVE I (CONCEPT I-W)

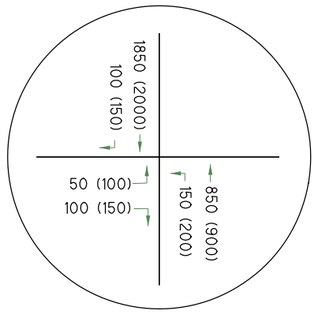
HNTB

INT. 9



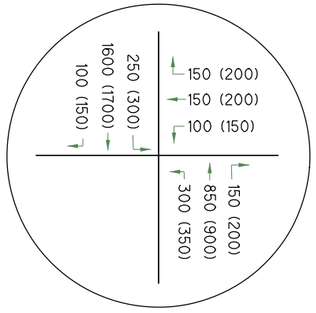
HARRISON STREET & WINCHELL AVENUE

INT. 10



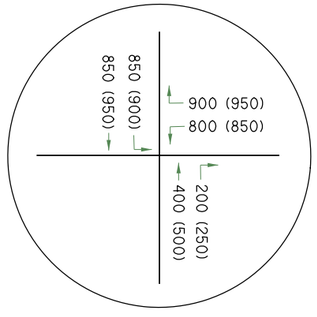
HARRISON STREET & PATTERSON STREET

INT. 11



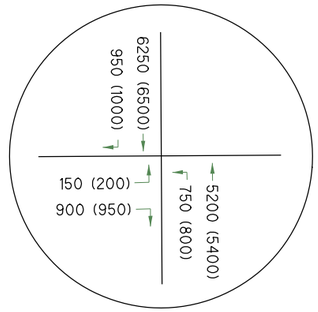
HARRISON STREET & COLERAIN AVENUE

INT. 12



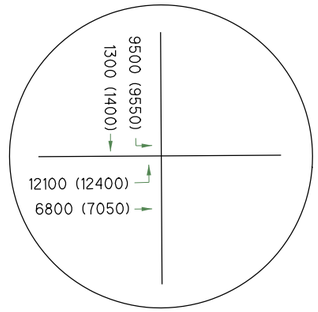
CENTRAL AVENUE & BRIGHTON PLACE

INT. 13



BRIGHTON PLACE & CENTRAL PARKWAY

INT. 14



WESTERN HILLS VIADUCT & WINCHELL RAMP

LEGEND

XXX (XXX) = 2029 AADT (2049 AADT)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

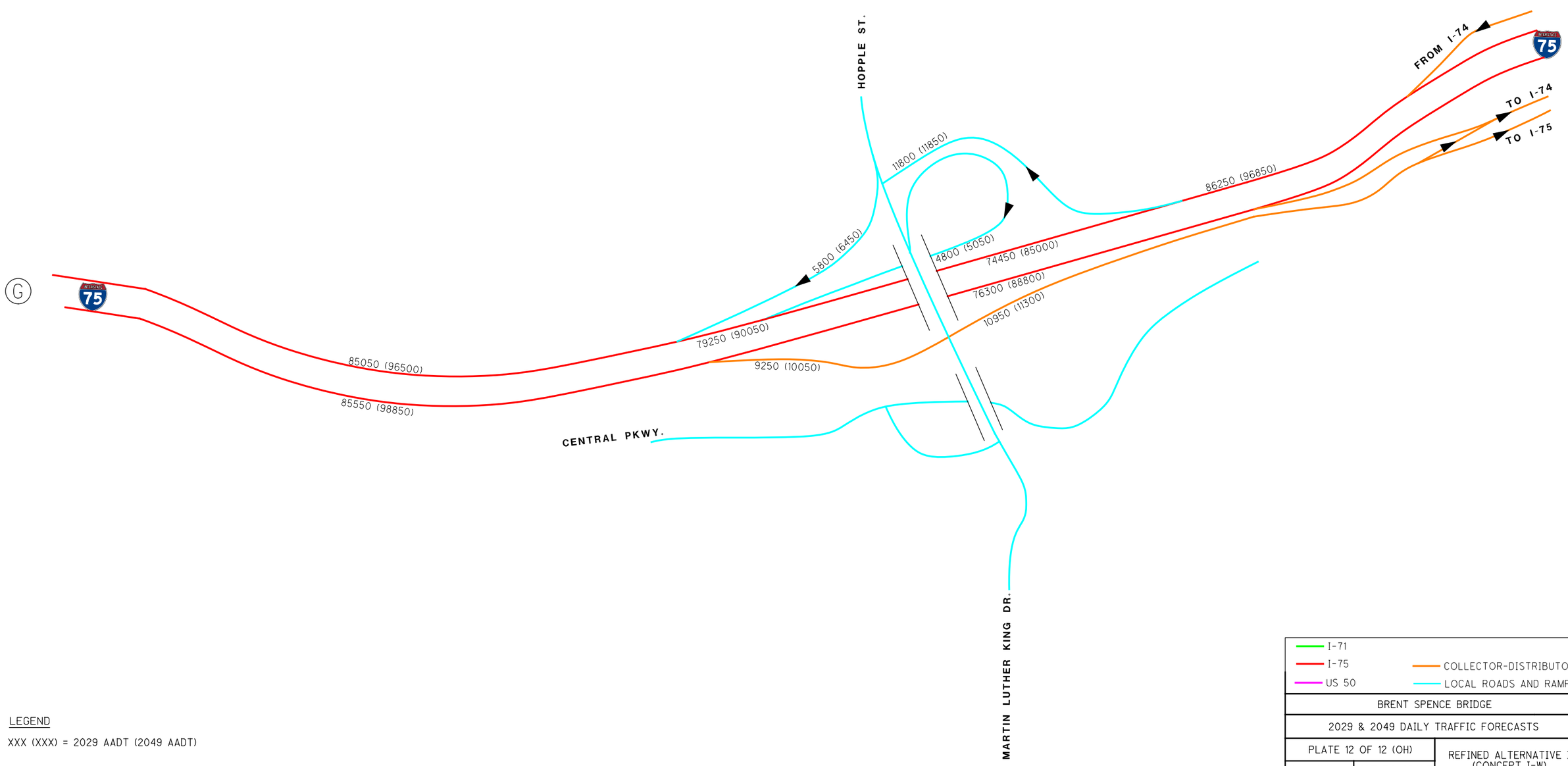
2029 & 2049 DAILY TRAFFIC FORECASTS

PLATE 11 OF 12 (OH)

MAY 2023 | NOT TO SCALE

REFINED ALTERNATIVE I (CONCEPT I-W)

HNTB



BRENT SPENCE BRIDGE

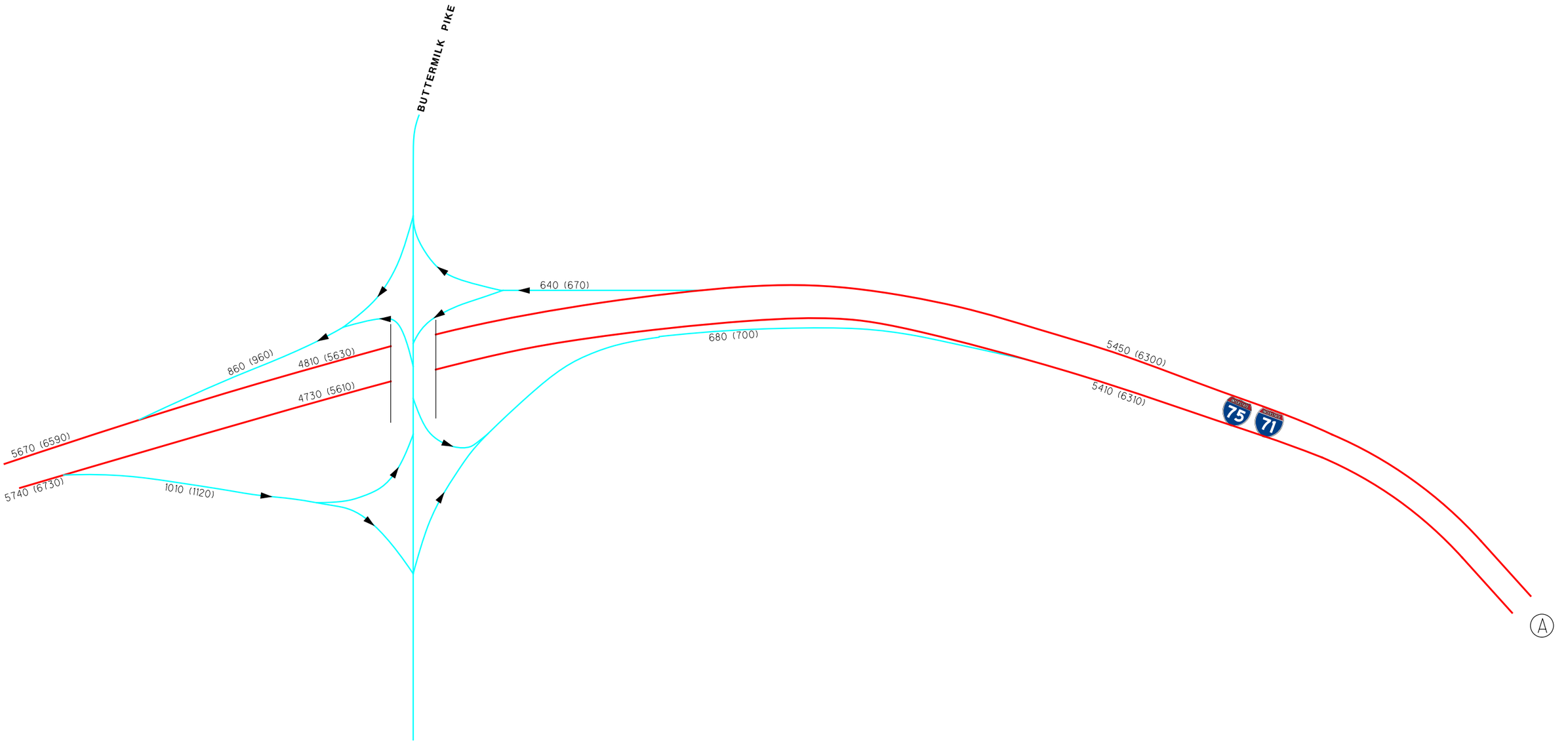
2029 & 2049 DAILY TRAFFIC FORECASTS

PLATE 12 OF 12 (OH)		REFINED ALTERNATIVE I (CONCEPT I-W)
MAY 2023	NOT TO SCALE	

HNTB

NOTE

BUTTERMILK DDI CONFIGURATION IS NOT INCLUDED IN BRENT SPENCE BRIDGE PROJECT.

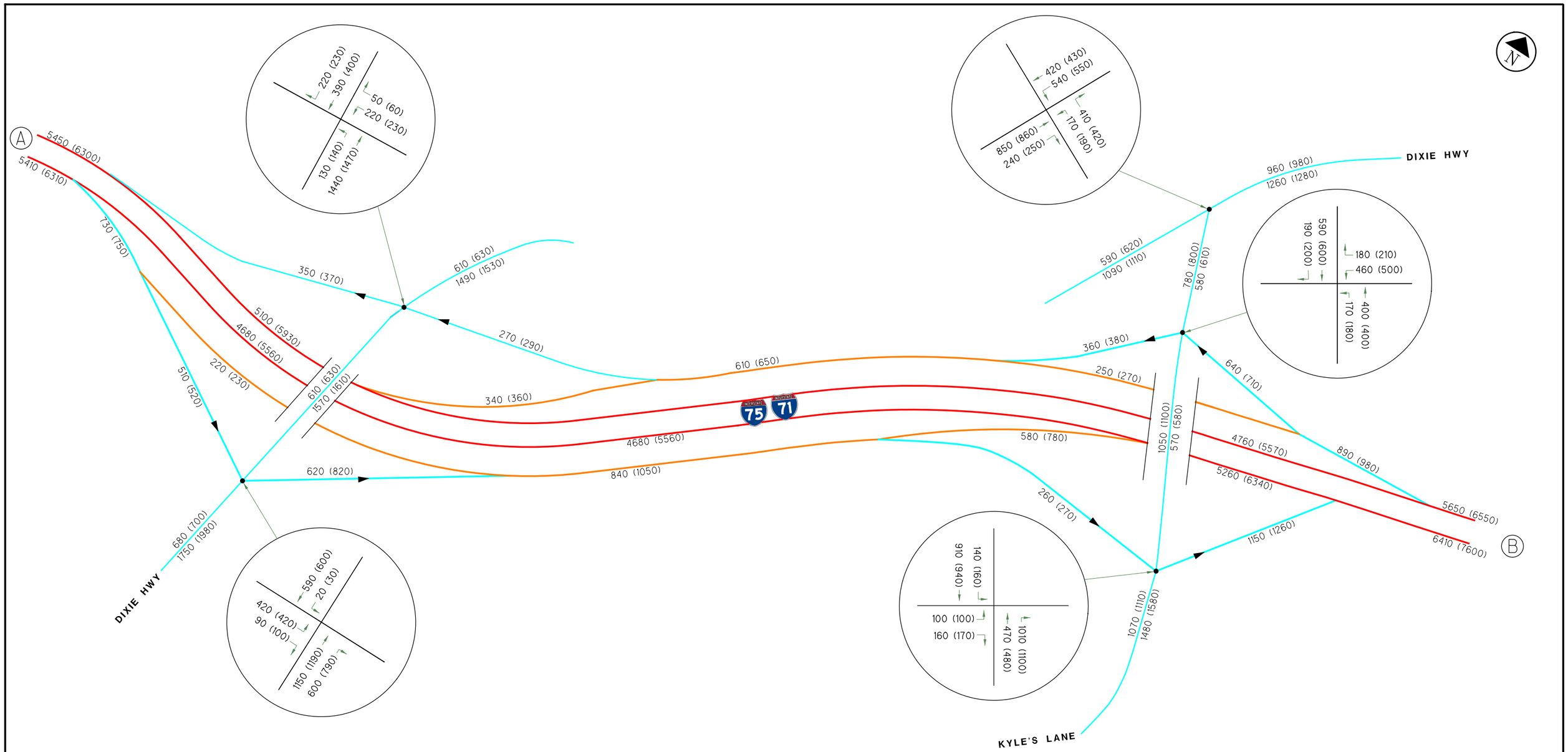


LEGEND

XXXX (XXXX) = 2029 AM DHV (2049 AM DHV)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE	
2029 & 2049 AM DHV TRAFFIC FORECASTS	
PLATE 1 OF 12 (KY)	REFINED ALTERNATIVE I (CONCEPT I-W)
MAY 2023 / NOT TO SCALE	
HNTB	



LEGEND

XXXX (XXXX) = 2029 AM DHV (2049 AM DHV)

BRENT SPENCE BRIDGE

2029 & 2049 AM DHV TRAFFIC FORECASTS

PLATE 2 OF 12 (KY)

REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023

NOT TO SCALE

HNTB

CRESCENT AVE.

N

C

B

5TH ST.

4TH ST.

BULLOCK ST.

12TH ST.

SIMON KENTON WAY

PIKE ST.

9TH ST.

MAIN ST.

BAKEWELL ST.

PHILADELPHIA ST.

INT. 1

INT. 2

INT. 3

INT. 4

IR-71/IR-75 SB LOWER LEVEL 3580 (4230)

IR-71/IR-75 NB UPPER LEVEL 4390 (5120)

LOCAL SB UPPER LEVEL 2280 (2530)

LOCAL NB LOWER LEVEL 3330 (3840)

LEGEND

XXXX (XXXX) = 2029 AM DHV (2049 AM DHV)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

2029 & 2049 AM DHV TRAFFIC FORECASTS

PLATE 3 OF 12 (KY)

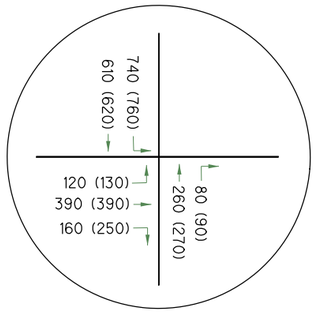
REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023

NOT TO SCALE

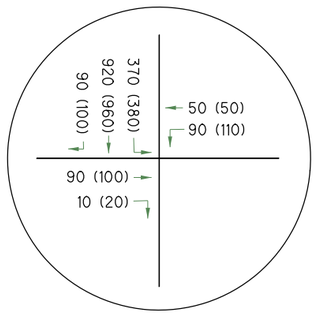
HNTB

INT. 1



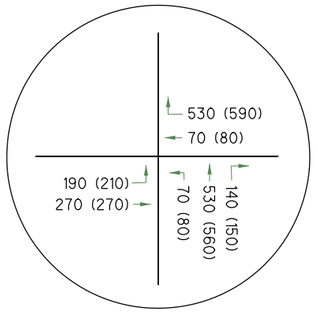
SIMON KENTON WAY & PIKE STREET

INT. 2



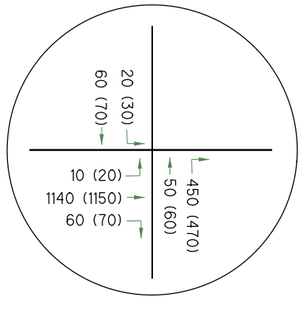
5TH STREET & PHILADELPHIA STREET

INT. 3



4TH STREET & PHILADELPHIA STREET

INT. 4



SIMON KENTON WAY & 9TH STREET

LEGEND

XXXX (XXXX) = 2029 AM DHV (2049 AM DHV)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

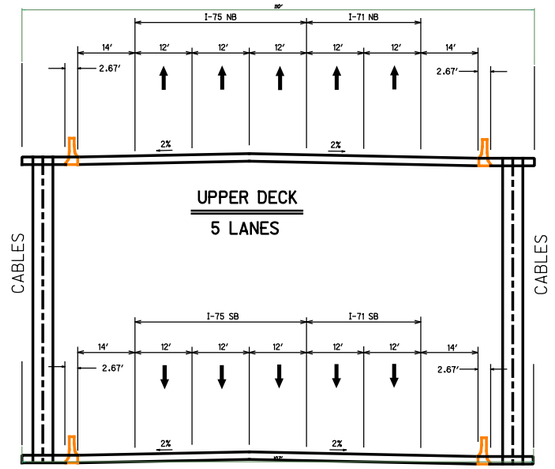
2029 & 2049 AM DHV TRAFFIC FORECASTS

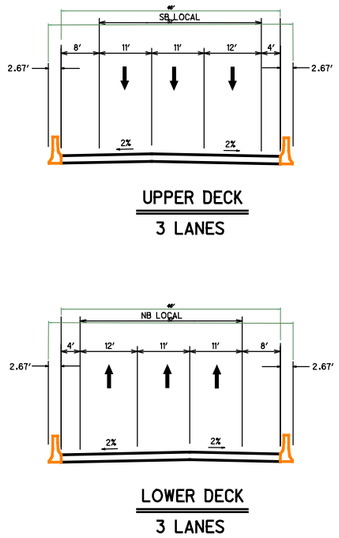
PLATE 4 OF 12 (KY)

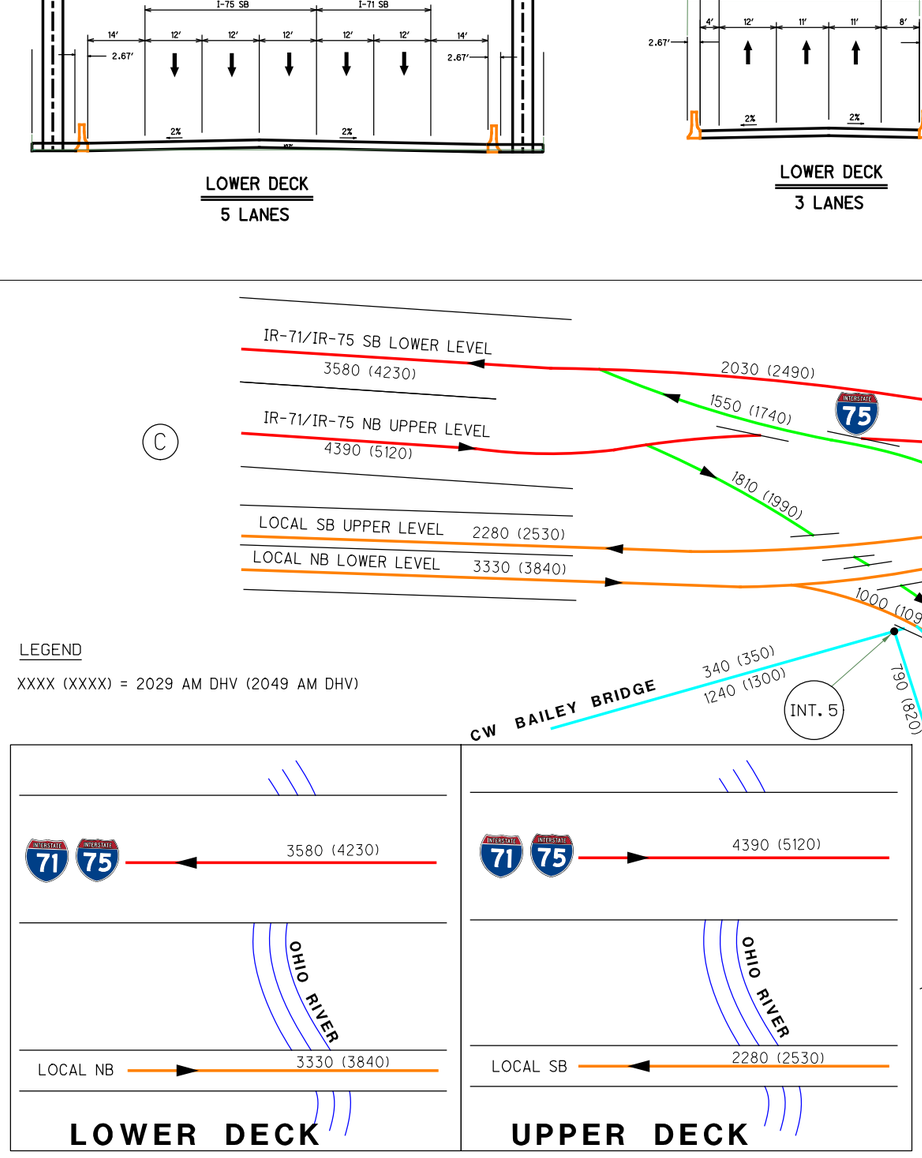
REFINED ALTERNATIVE I
(CONCEPT I-W)

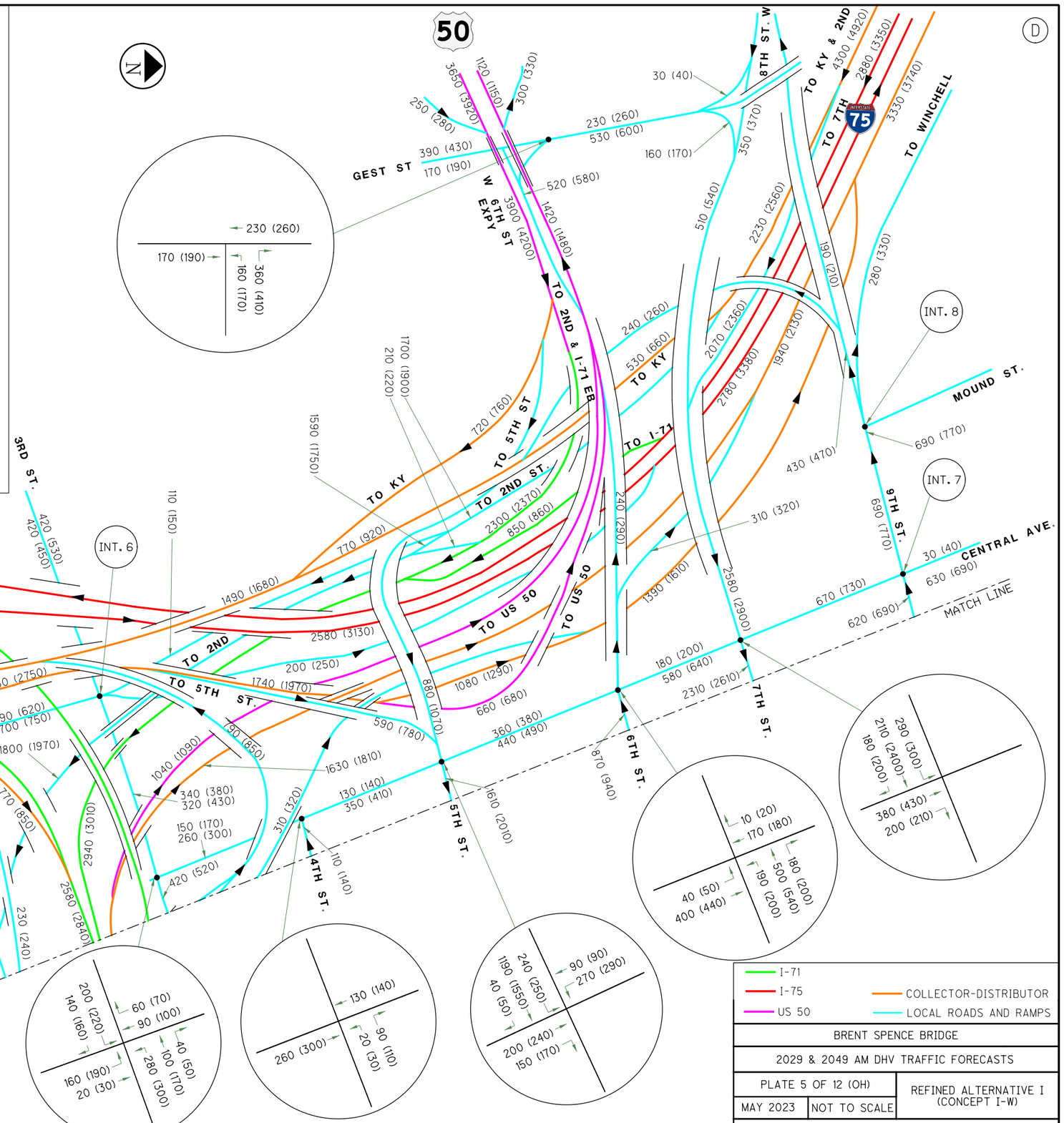
MAY 2023 | NOT TO SCALE

HNTB









BRENT SPENCE BRIDGE

2029 & 2049 AM DHV TRAFFIC FORECASTS

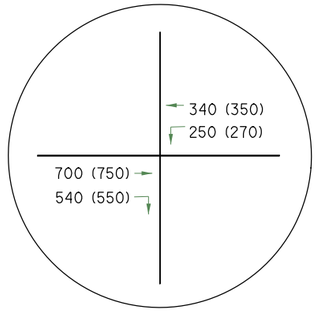
PLATE 5 OF 12 (OH)

MAY 2023 | NOT TO SCALE

REFINED ALTERNATIVE I (CONCEPT I-W)

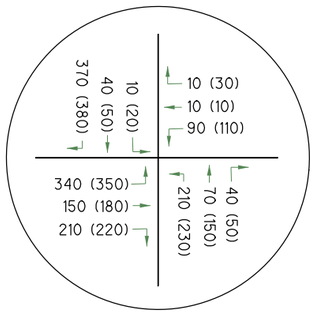
HNTB

INT. 5



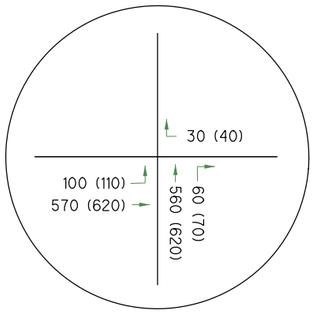
CW BAILEY BRIDGE & 2ND STREET

INT. 6



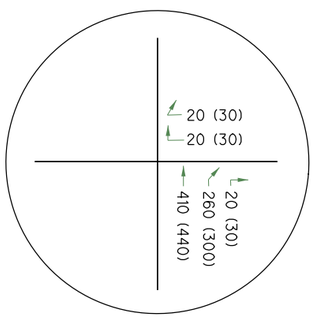
CW BAILEY BRIDGE & 3RD STREET

INT. 7



CENTRAL AVENUE & 9TH STREET

INT. 8



MOUND STREET & 9TH STREET

LEGEND

XXXX (XXXX) = 2029 AM DHV (2049 AM DHV)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

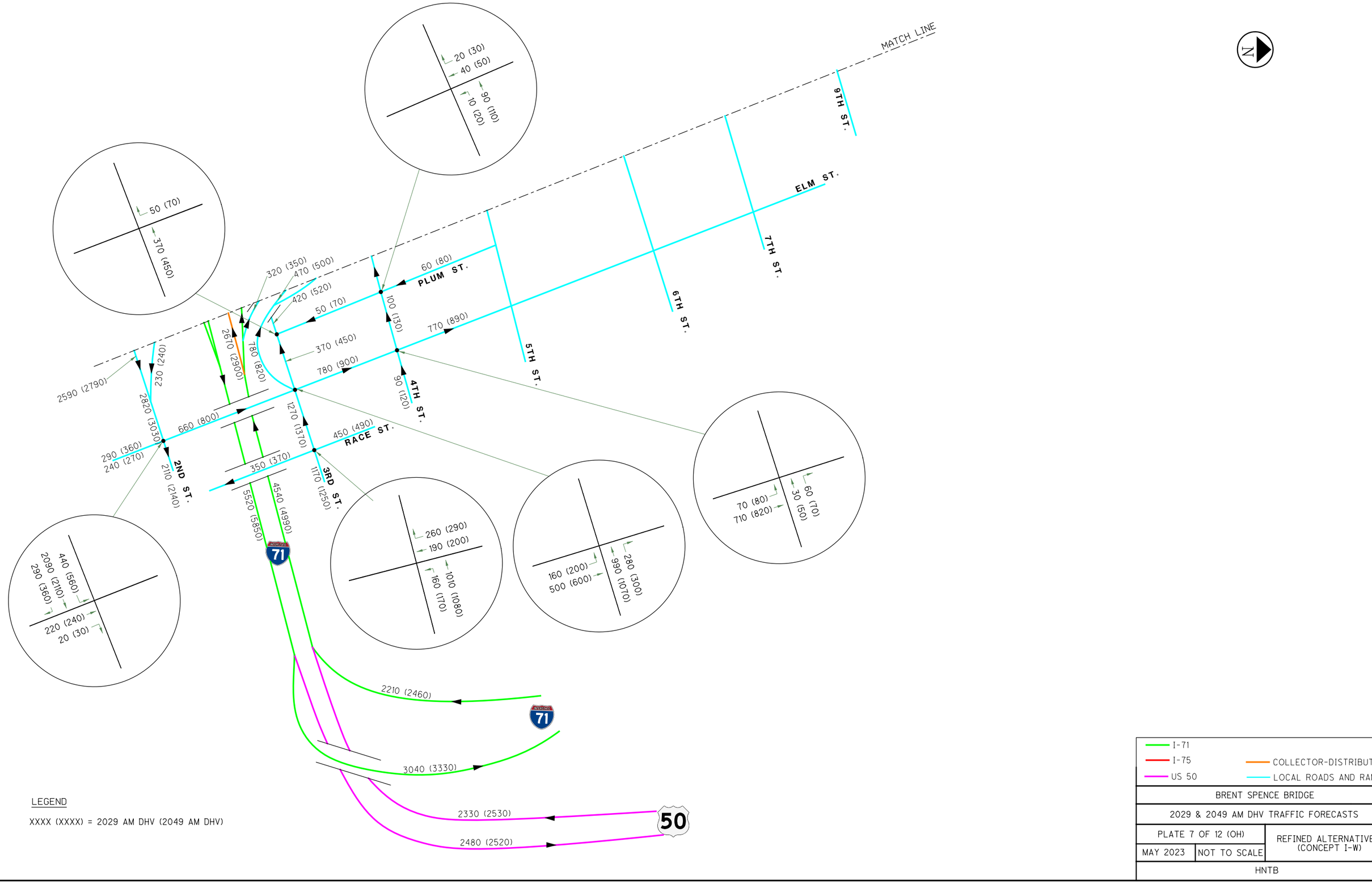
2029 & 2049 AM DHV TRAFFIC FORECASTS

PLATE 6 OF 12 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB



LEGEND

XXXX (XXXX) = 2029 AM DHV (2049 AM DHV)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

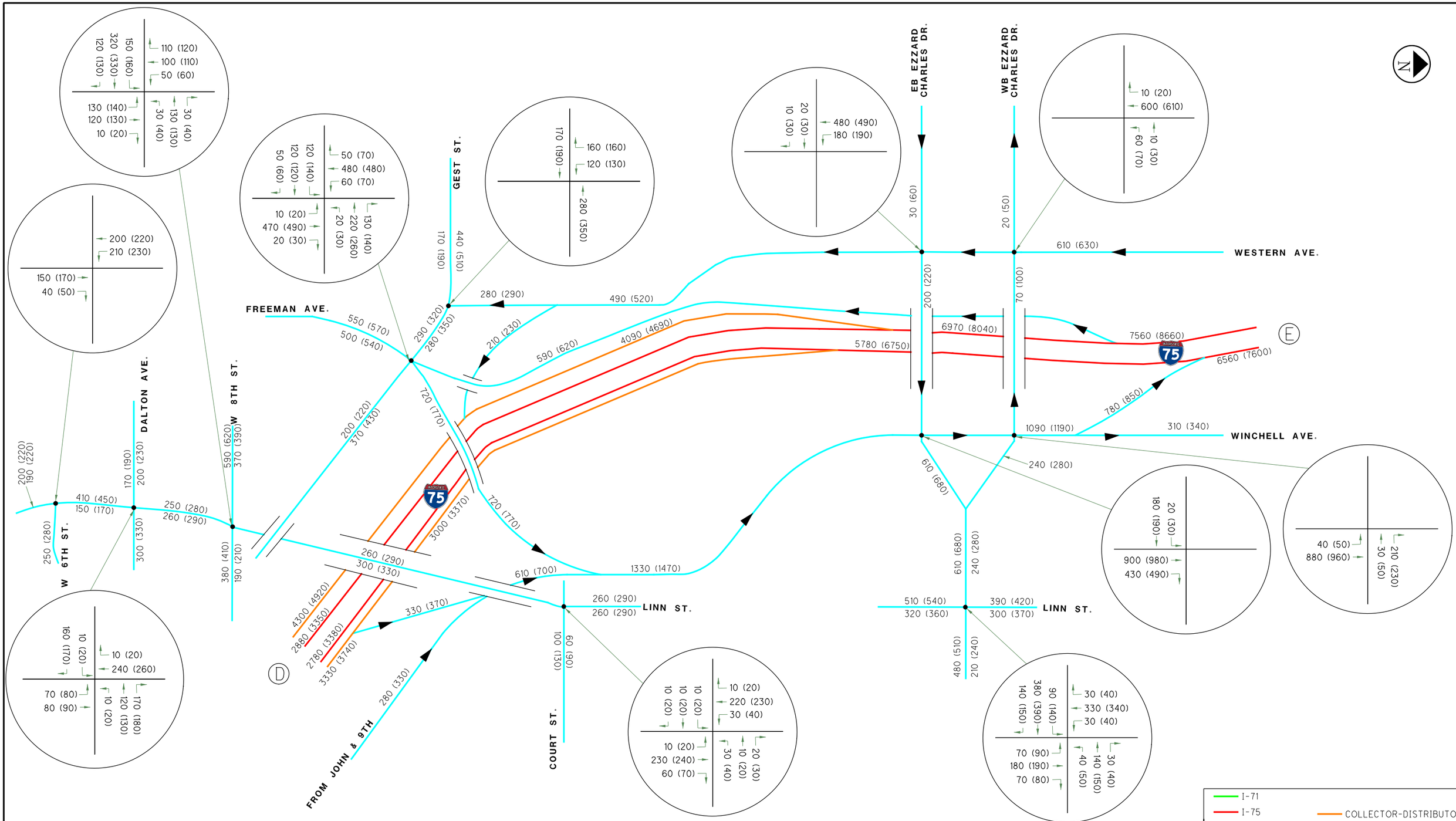
2029 & 2049 AM DHV TRAFFIC FORECASTS

PLATE 7 OF 12 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB



BRENT SPENCE BRIDGE

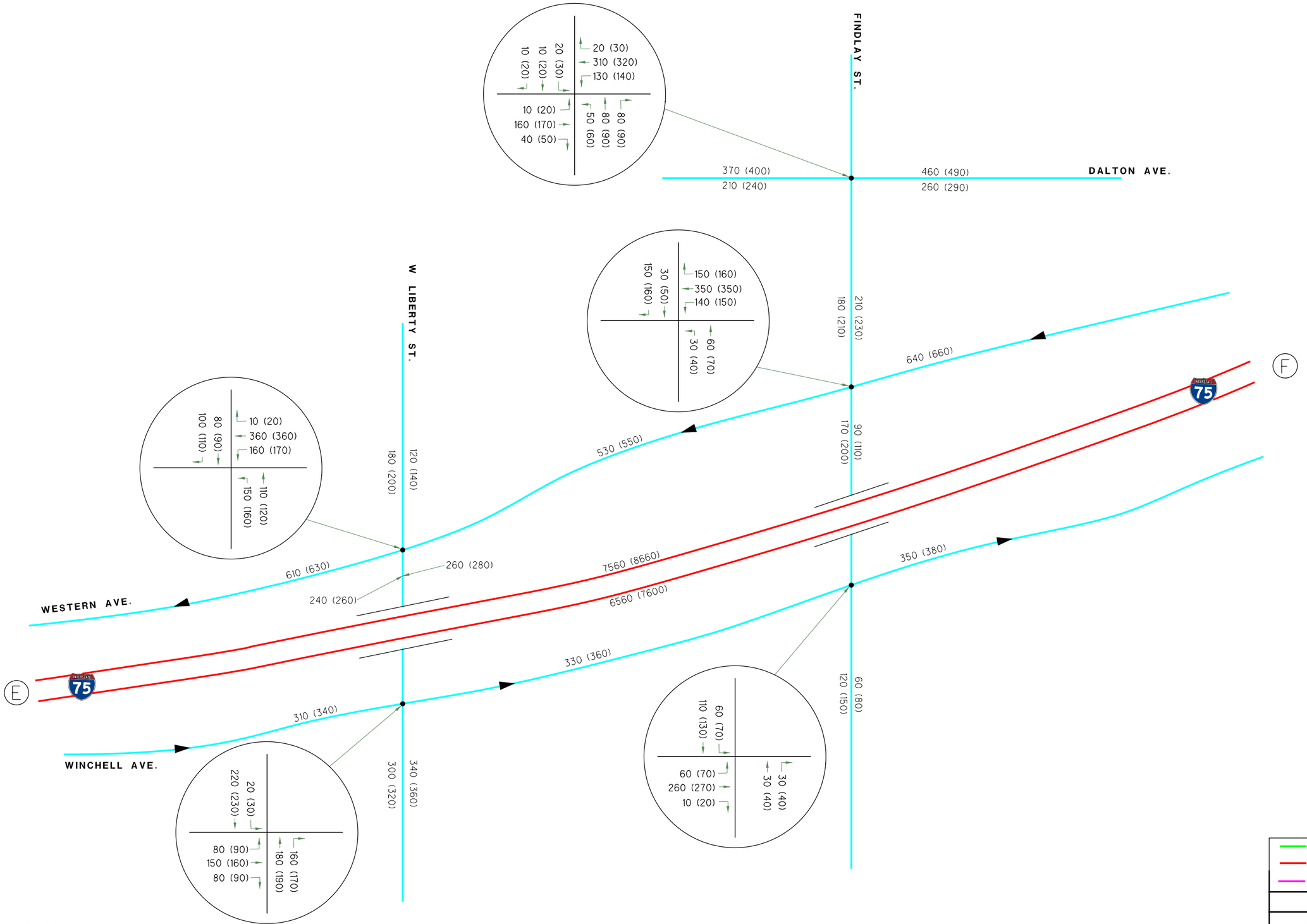
2029 & 2049 AM DHV TRAFFIC FORECASTS

PLATE 8 OF 12 (OH)

MAY 2023 | NOT TO SCALE

REFINED ALTERNATIVE I (CONCEPT I-W)

HNTB



LEGEND

XXXX (XXXX) = 2029 AM DHV (2049 AM DHV)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

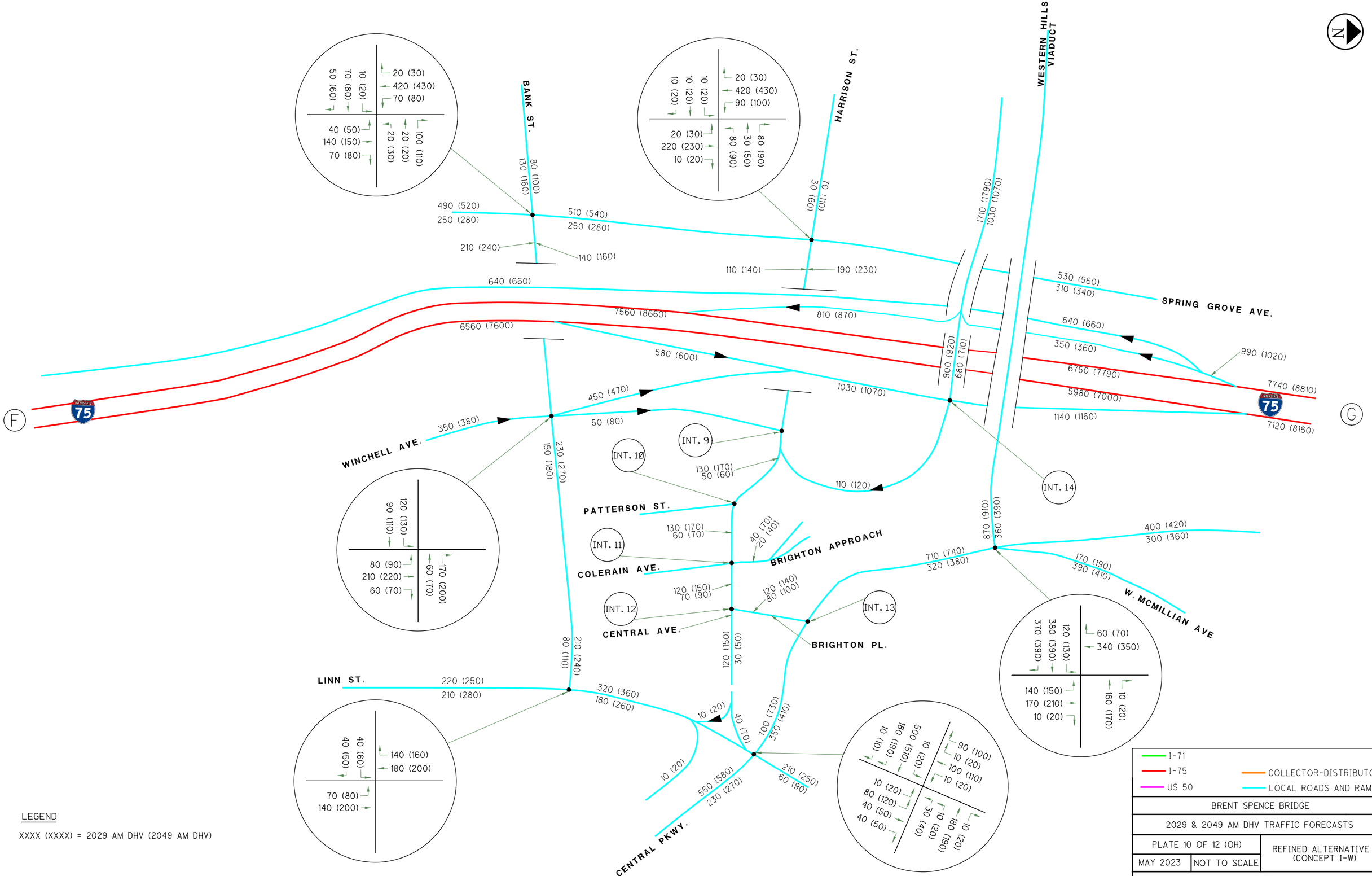
2029 & 2049 AM DHV TRAFFIC FORECASTS

PLATE 9 OF 12 (OH)

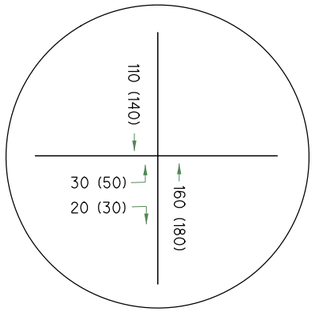
REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB

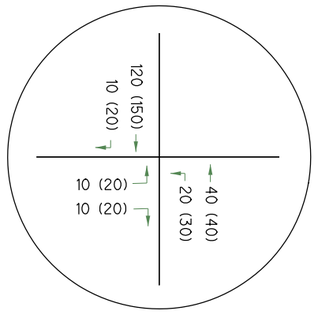

N
F
G
INTERSTATE 75
BANK ST.
HARRISON ST.
WESTERN HILLS VIADUCT
SPRING GROVE AVE.
WINCHELL AVE.
PATTERSON ST.
COLERAIN AVE.
CENTRAL AVE.
BRIGHTON APPROACH
BRIGHTON PL.
W. MCMILLIAN AVE
LINN ST.
CENTRAL PKWY.
INT. 9
INT. 10
INT. 11
INT. 12
INT. 13
INT. 14
20 (30)
420 (430)
70 (80)
50 (60)
70 (80)
10 (20)
40 (50)
140 (150)
70 (80)
20 (30)
20 (20)
100 (110)
10 (20)
10 (20)
10 (20)
20 (30)
420 (430)
90 (100)
20 (30)
220 (230)
10 (20)
80 (90)
30 (50)
80 (90)
80 (100)
130 (160)
70 (110)
30 (60)
490 (520)
250 (280)
510 (540)
250 (280)
210 (240)
140 (160)
110 (140)
190 (230)
640 (660)
7560 (8660)
6560 (7600)
810 (870)
1710 (1790)
1030 (1070)
530 (560)
310 (340)
640 (660)
350 (360)
990 (1020)
6750 (7790)
5980 (7000)
1140 (1160)
7740 (8810)
7120 (8160)
900 (920)
680 (710)
580 (600)
1030 (1070)
450 (470)
50 (80)
350 (380)
150 (180)
230 (270)
130 (170)
50 (60)
110 (120)
870 (910)
360 (390)
130 (170)
60 (70)
40 (70)
20 (40)
710 (740)
320 (380)
400 (420)
300 (360)
170 (190)
390 (410)
120 (150)
70 (90)
120 (140)
80 (100)
120 (150)
30 (50)
80 (110)
210 (240)
320 (360)
180 (260)
220 (250)
210 (280)
10 (20)
40 (70)
700 (730)
350 (410)
10 (20)
550 (580)
230 (270)
210 (250)
60 (90)
120 (130)
90 (110)
80 (90)
210 (220)
60 (70)
60 (70)
170 (200)
370 (390)
380 (390)
120 (130)
60 (70)
340 (350)
140 (150)
170 (210)
10 (20)
160 (170)
10 (20)
40 (50)
40 (60)
140 (160)
180 (200)
70 (80)
140 (200)
10 (10)
180 (190)
500 (510)
10 (20)
90 (100)
10 (20)
100 (110)
10 (20)
10 (20)
80 (120)
40 (50)
40 (50)
10 (20)
30 (40)
180 (190)
10 (20)
LEGEND
XXXX (XXXX) = 2029 AM DHV (2049 AM DHV)
I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
BRENT SPENCE BRIDGE
2029 & 2049 AM DHV TRAFFIC FORECASTS
PLATE 10 OF 12 (OH)
REFINED ALTERNATIVE I (CONCEPT I-W)
MAY 2023
NOT TO SCALE
HNTB

INT. 9



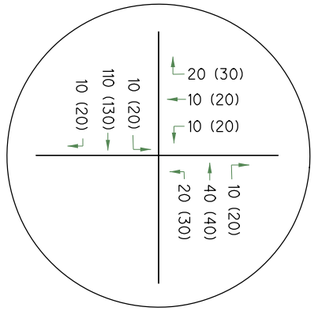
HARRISON STREET & WINCHELL AVENUE

INT. 10



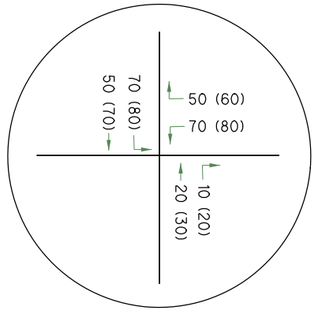
HARRISON STREET & PATTERSON STREET

INT. 11



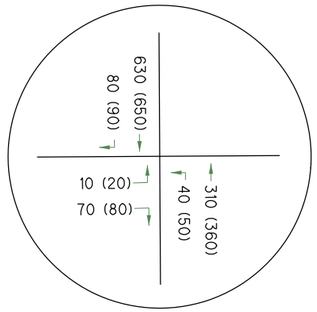
HARRISON STREET & COLERAIN AVENUE

INT. 12



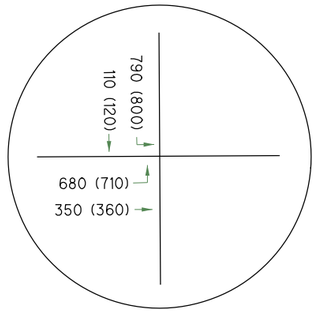
CENTRAL AVENUE & BRIGHTON PLACE

INT. 13



BRIGHTON PLACE & CENTRAL PARKWAY

INT. 14



WESTERN HILLS VIADUCT & WINCHELL RAMP

LEGEND

XXXX (XXXX) = 2029 AM DHV (2049 AM DHV)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

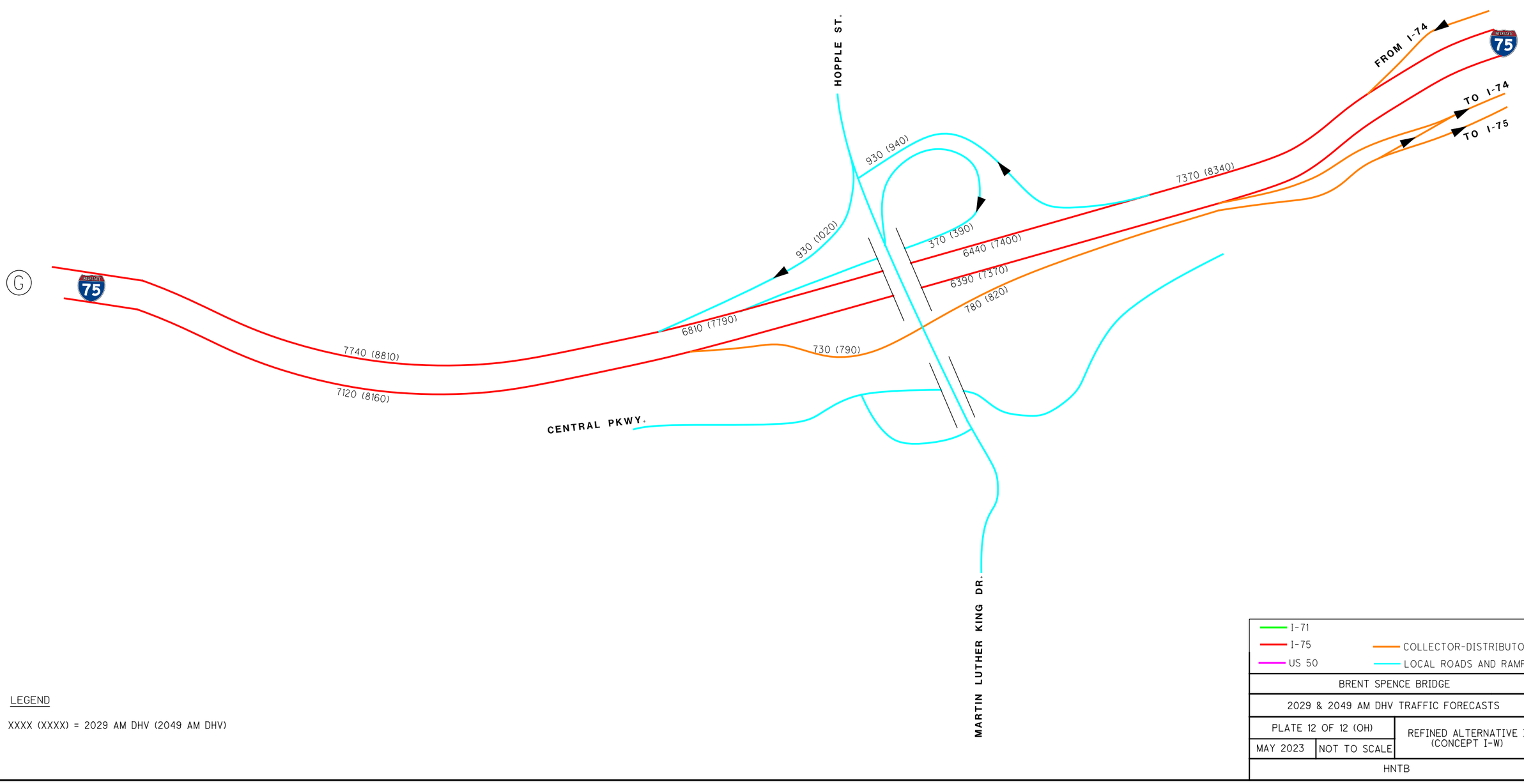
2029 & 2049 AM DHV TRAFFIC FORECASTS

PLATE 11 OF 12 (OH)

MAY 2023 | NOT TO SCALE

REFINED ALTERNATIVE I (CONCEPT I-W)

HNTB



BRENT SPENCE BRIDGE

2029 & 2049 AM DHV TRAFFIC FORECASTS

PLATE 12 OF 12 (OH)

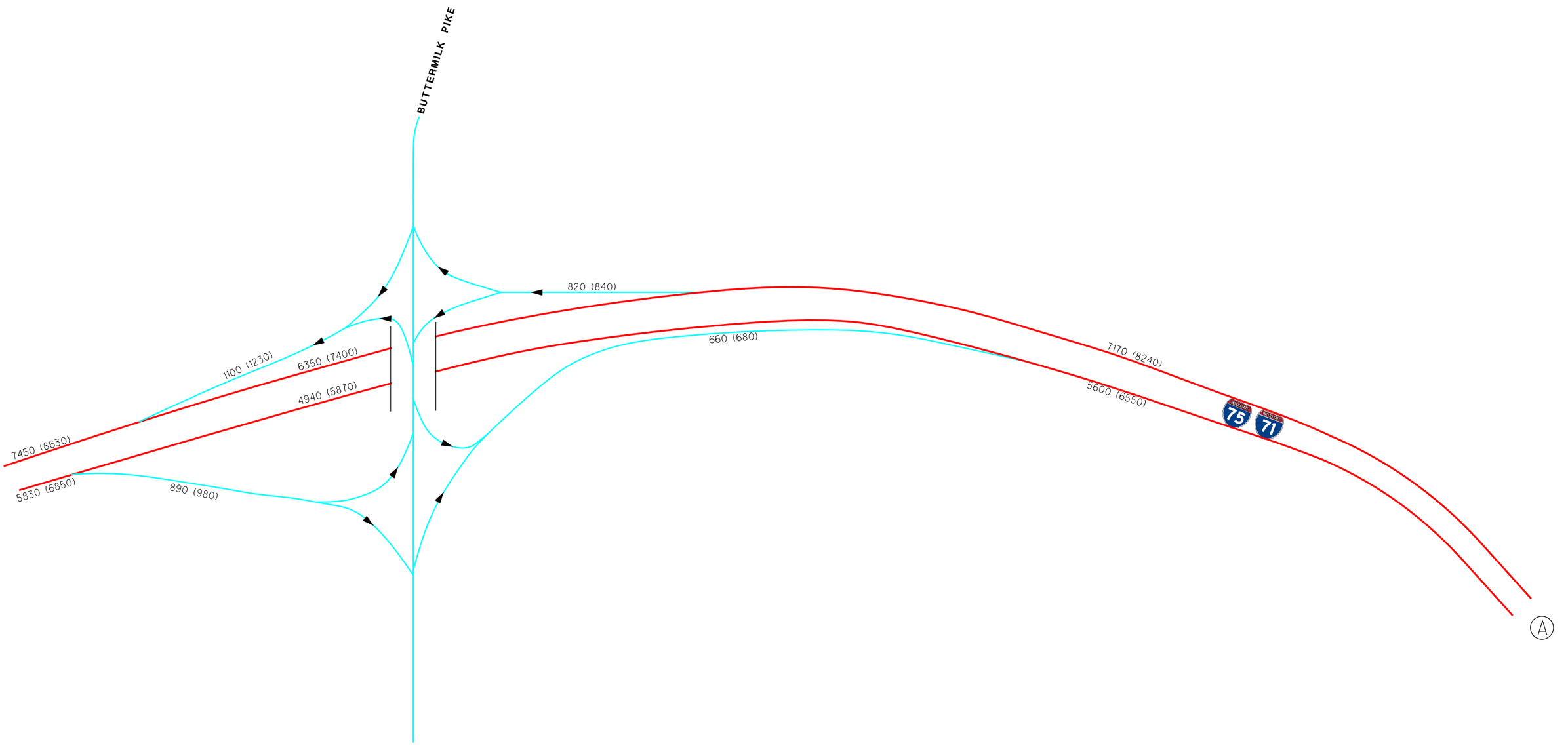
REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB

NOTE

BUTTERMILK DDI CONFIGURATION IS NOT INCLUDED IN BRENT SPENCE BRIDGE PROJECT.



LEGEND

XXXX (XXXX) = 2029 PM DHV (2049 PM DHV)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

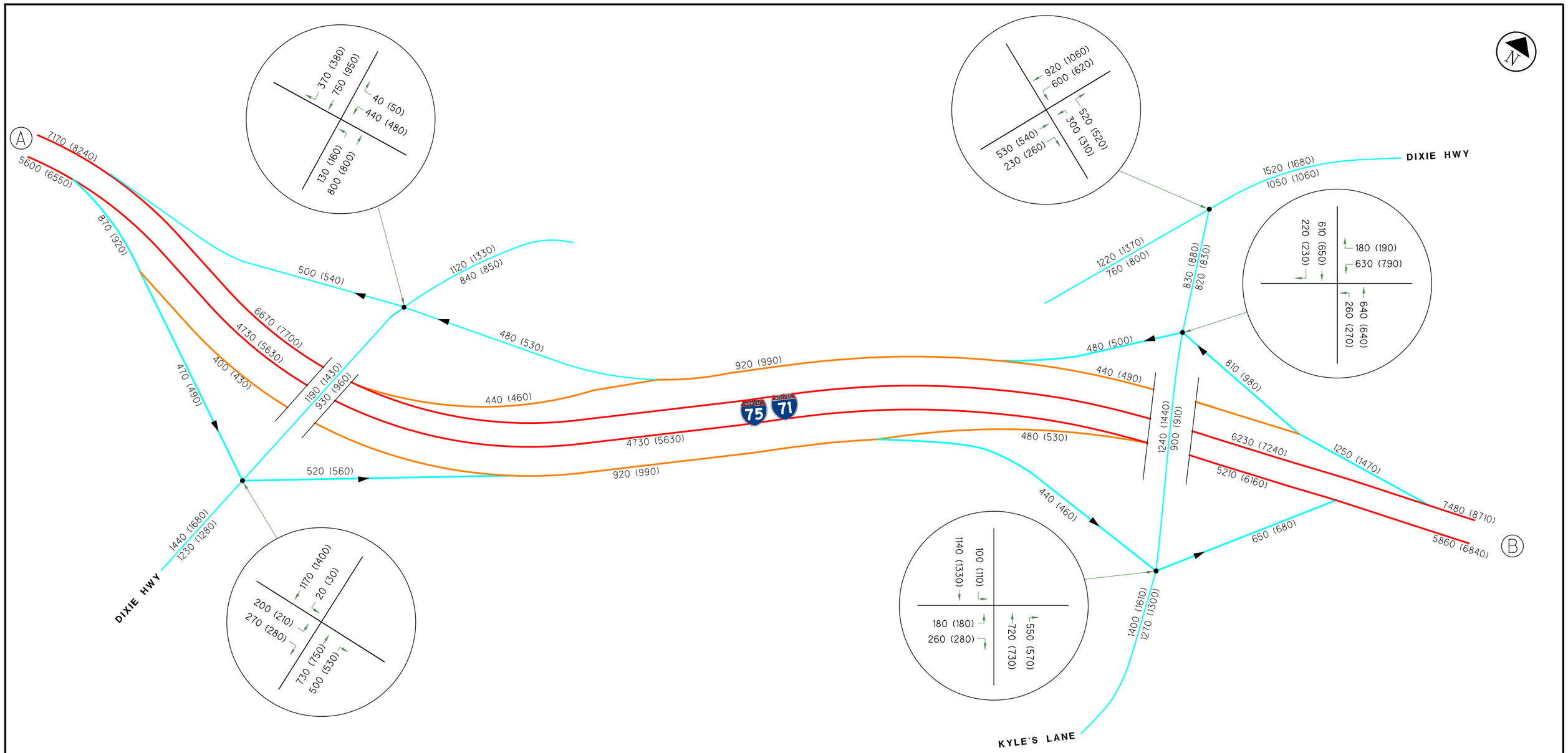
2029 & 2049 PM DHV TRAFFIC FORECASTS

PLATE 1 OF 12 (KY)

REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB



LEGEND

XXXX (XXXX) = 2029 PM DHV (2049 PM DHV)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

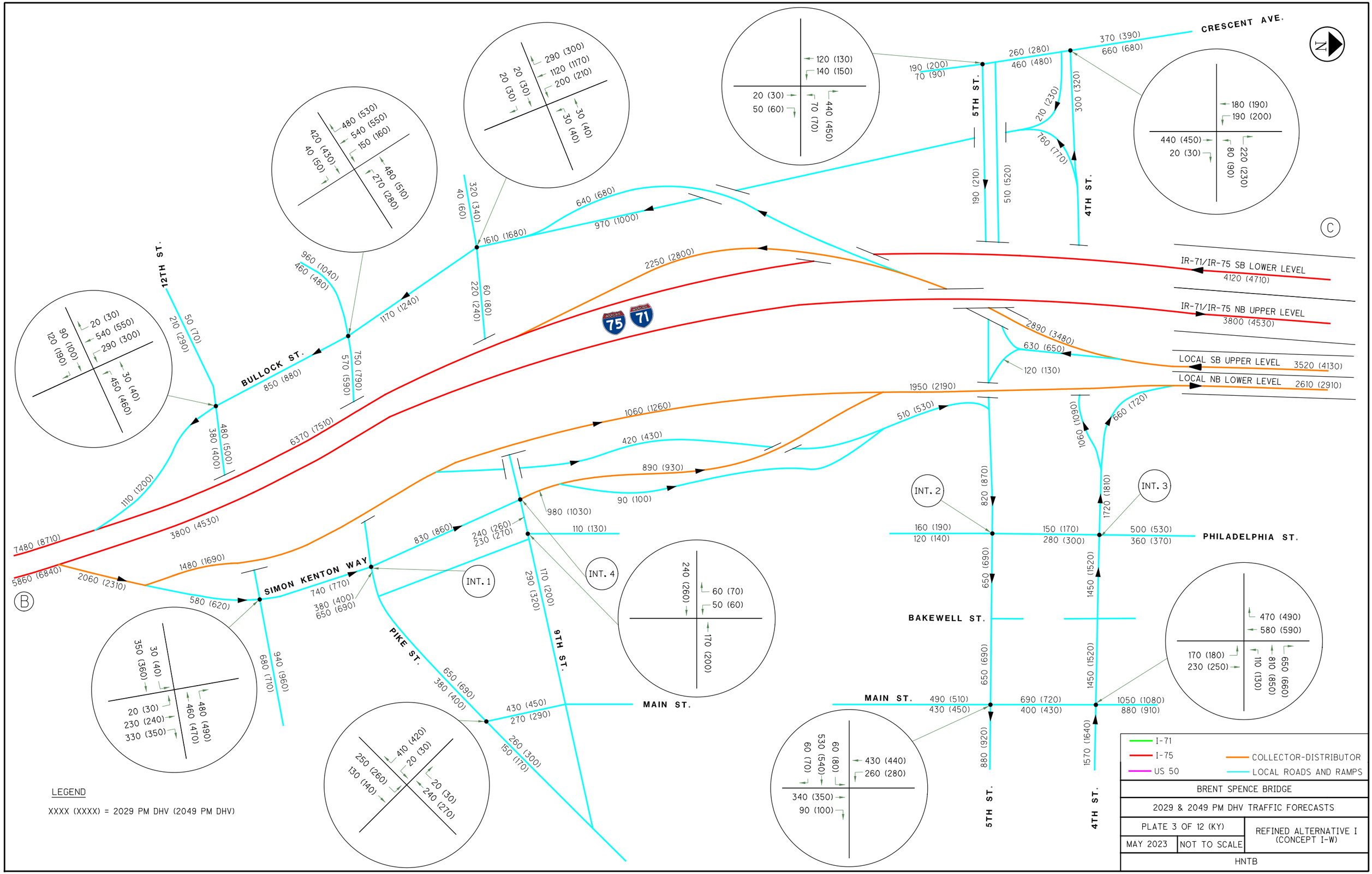
2029 & 2049 PM DHV TRAFFIC FORECASTS

PLATE 2 OF 12 (KY)

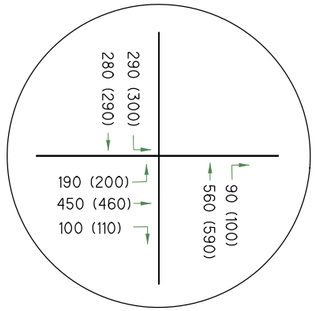
REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB

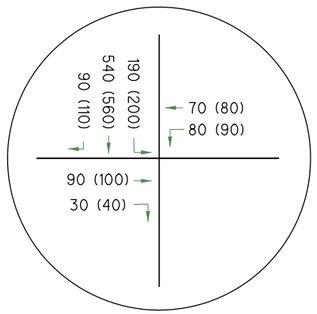

CRESCENT AVE.
5TH ST.
4TH ST.
BULLOCK ST.
12TH ST.
SIMON KENTON WAY
PIKE ST.
9TH ST.
MAIN ST.
PHILADELPHIA ST.
BAKEWELL ST.
INT. 1
INT. 2
INT. 3
INT. 4
I-75
I-71
IR-71/IR-75 SB LOWER LEVEL 4120 (4710)
IR-71/IR-75 NB UPPER LEVEL 3800 (4530)
LOCAL SB UPPER LEVEL 3520 (4130)
LOCAL NB LOWER LEVEL 2610 (2910)
B
C
N
LEGEND
XXXX (XXXX) = 2029 PM DHV (2049 PM DHV)
I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
BRENT SPENCE BRIDGE
2029 & 2049 PM DHV TRAFFIC FORECASTS
PLATE 3 OF 12 (KY)
REFINED ALTERNATIVE I (CONCEPT I-W)
MAY 2023
NOT TO SCALE
HNTB

INT. 1



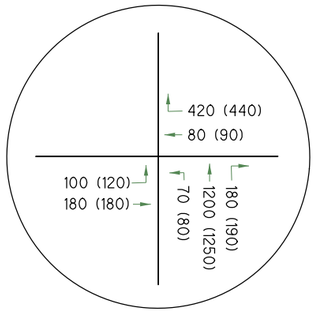
SIMON KENTON WAY & PIKE STREET

INT. 2



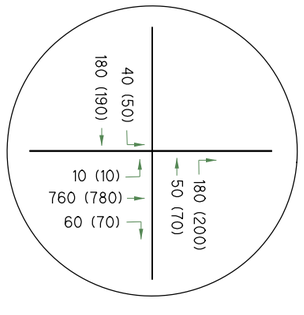
5TH STREET & PHILADELPHIA STREET

INT. 3



4TH STREET & PHILADELPHIA STREET

INT. 4



JILLIANS WAY & 9TH STREET

LEGEND

XXXX (XXXX) = 2029 PM DHV (2049 PM DHV)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

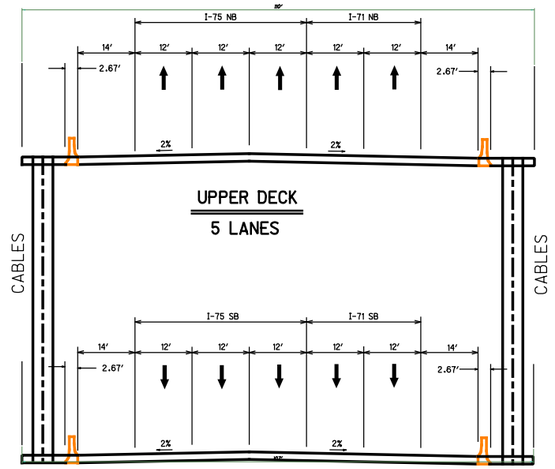
2029 & 2049 PM DHV TRAFFIC FORECASTS

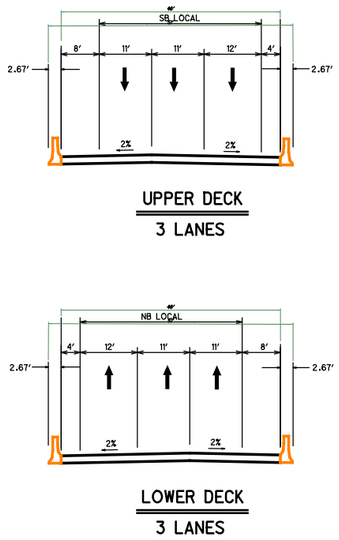
PLATE 4 OF 12 (KY)

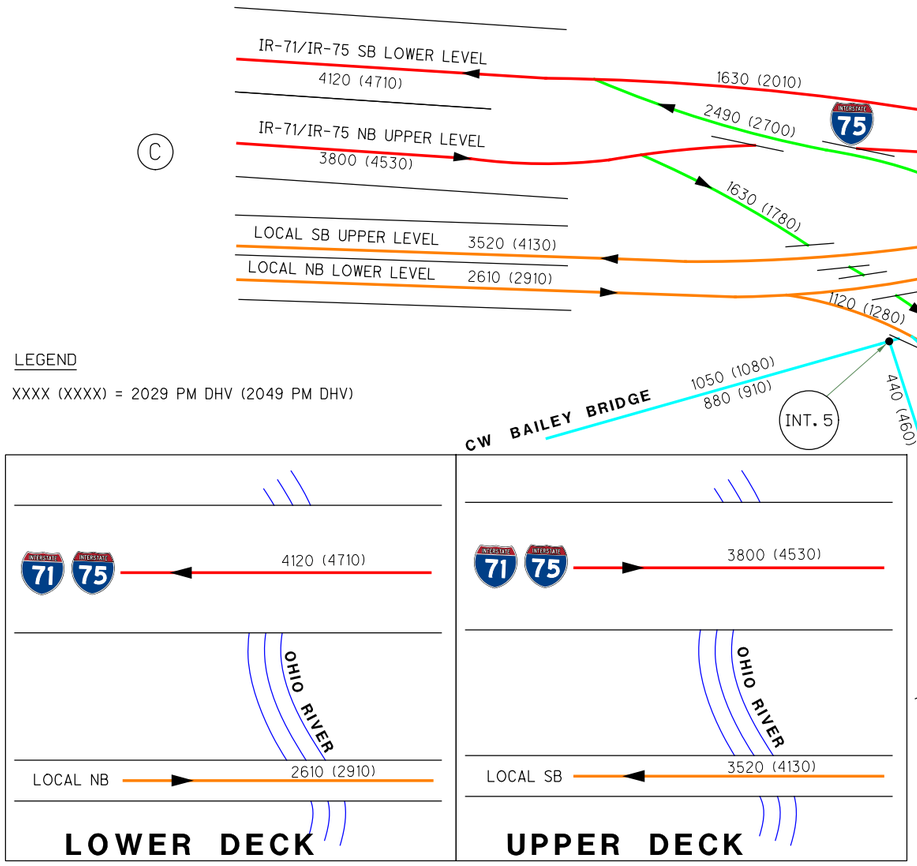
REFINED ALTERNATIVE I
(CONCEPT I-W)

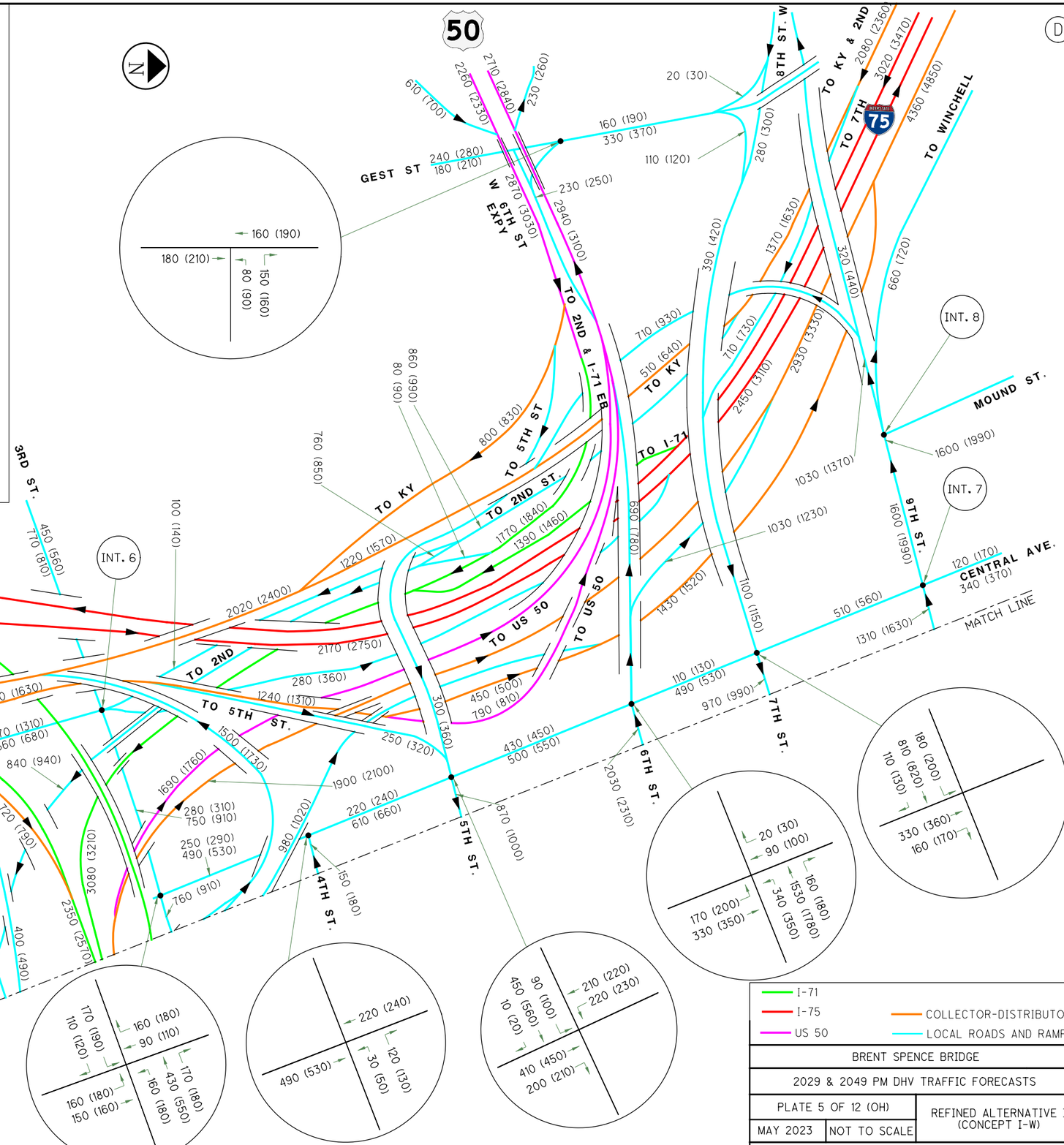
MAY 2023 | NOT TO SCALE

HNTB









BRENT SPENCE BRIDGE

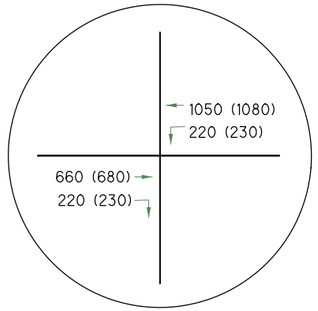
2029 & 2049 PM DHV TRAFFIC FORECASTS

PLATE 5 OF 12 (OH) | REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

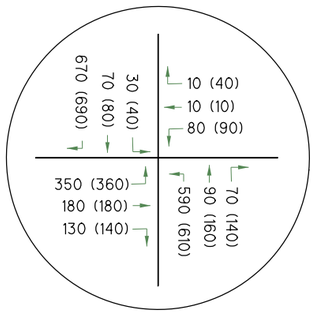
HNTB

INT. 5



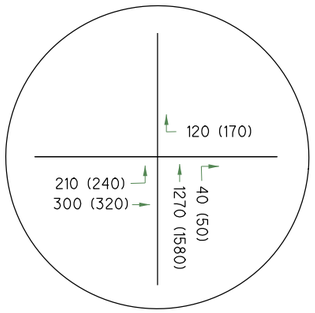
CW BAILEY BRIDGE & 2ND STREET

INT. 6



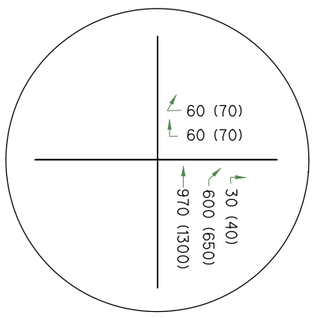
CW BAILEY BRIDGE & 3RD STREET

INT. 7



CENTRAL AVENUE & 9TH STREET

INT. 8



MOUND STREET & 9TH STREET

LEGEND

XXXX (XXXX) = 2029 PM DHV (2049 PM DHV)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

2029 & 2049 PM DHV TRAFFIC FORECASTS

PLATE 6 OF 12 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB

MATCH LINE

N

50 (60)
50 (100)
100 (120)
20 (80)

70 (180)
690 (730)

500 (550)
1000 (1180)
760 (910)
70 (180)
100 (160)
PLUM ST.
120 (200)
530 (590)
690 (730)
520 (580)
1980 (2200)
3590 (3860)
1280 (1400)
400 (490)
1680 (1890)
610 (660)
160 (190)
400 (440)
2580 (2850)
1560 (1660)
RACE ST.
810 (910)
1310 (1480)
2ND ST.
3RD ST.
1830 (2100)
4TH ST.
130 (210)
5TH ST.
6TH ST.
7TH ST.
ELM ST.
9TH ST.
5430 (5780)
6580 (7110)

880 (890)
680 (770)
130 (140)
1700 (1960)

300 (310)
310 (350)
210 (230)
2370 (2620)

60 (70)
460 (510)
60 (130)
70 (80)

290 (310)
1230 (1390)
160 (190)
320 (350)
80 (90)

3500 (3830)
2180 (2420)
3080 (3280)
3250 (3360)

LEGEND

XXXX (XXXX) = 2029 PM DHV (2049 PM DHV)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

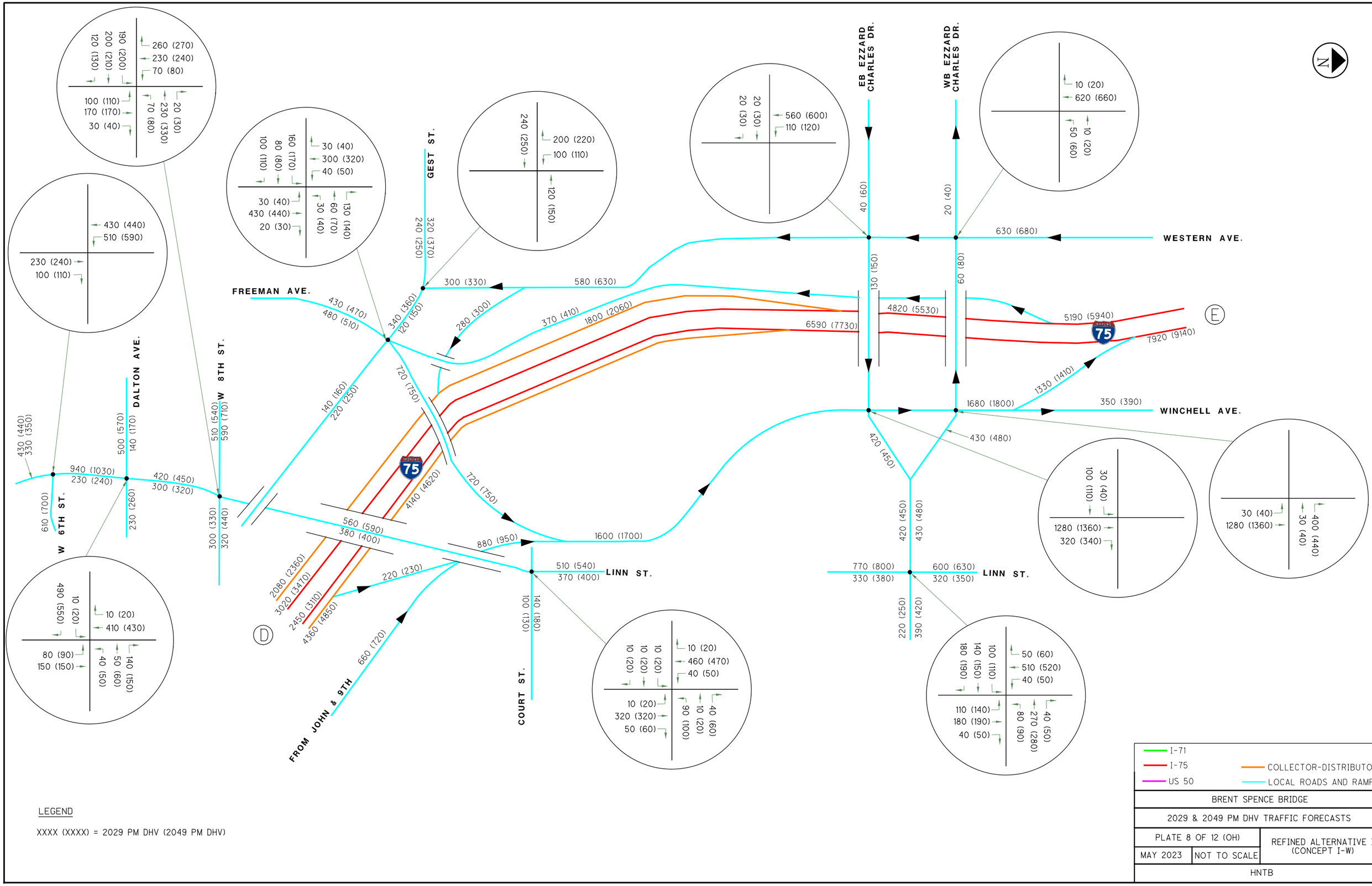
2029 & 2049 PM DHV TRAFFIC FORECASTS

PLATE 7 OF 12 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB



LEGEND

XXXX (XXXX) = 2029 PM DHV (2049 PM DHV)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

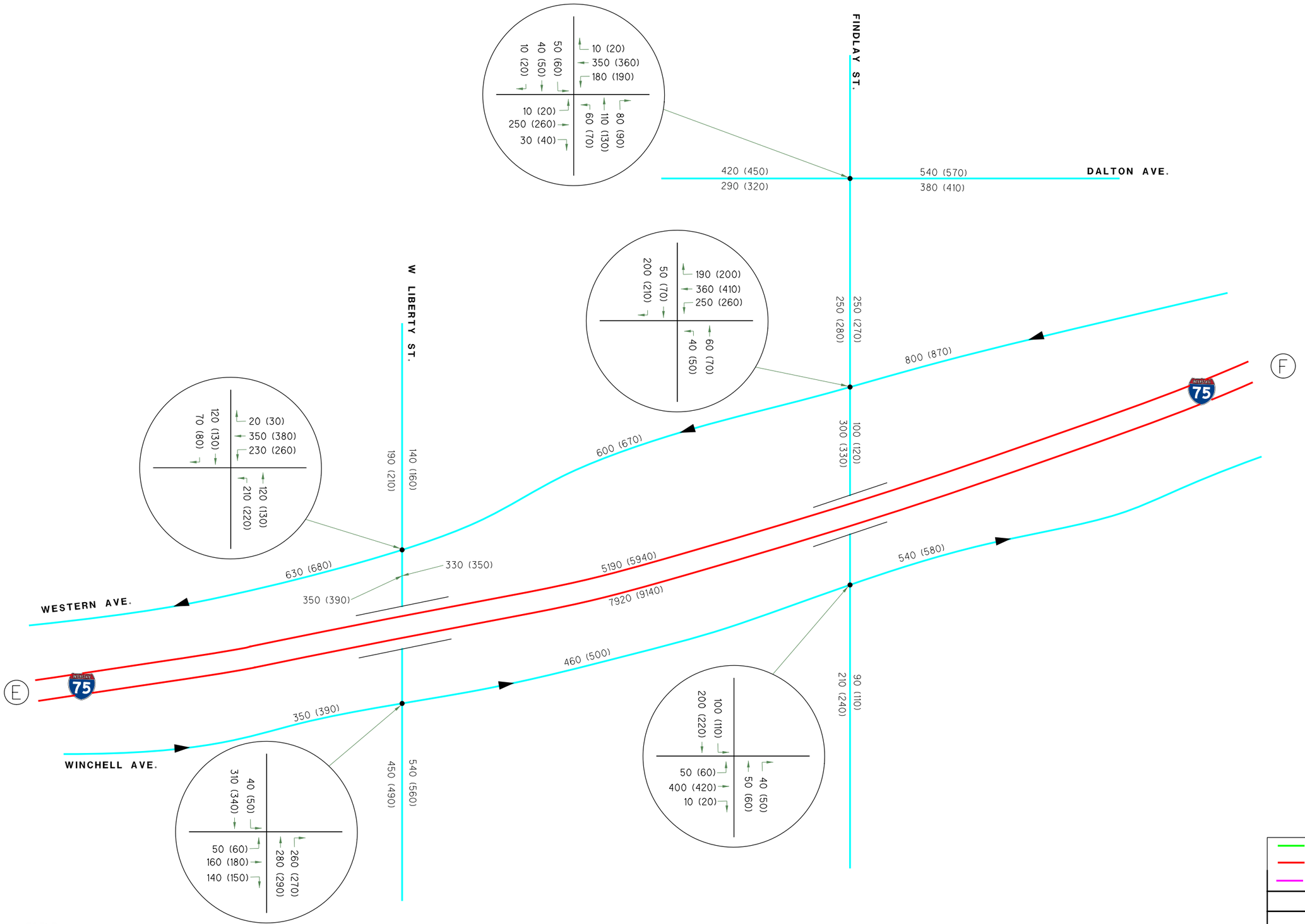
2029 & 2049 PM DHV TRAFFIC FORECASTS

PLATE 8 OF 12 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB



LEGEND

XXXX (XXXX) = 2029 PM DHV (2049 PM DHV)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

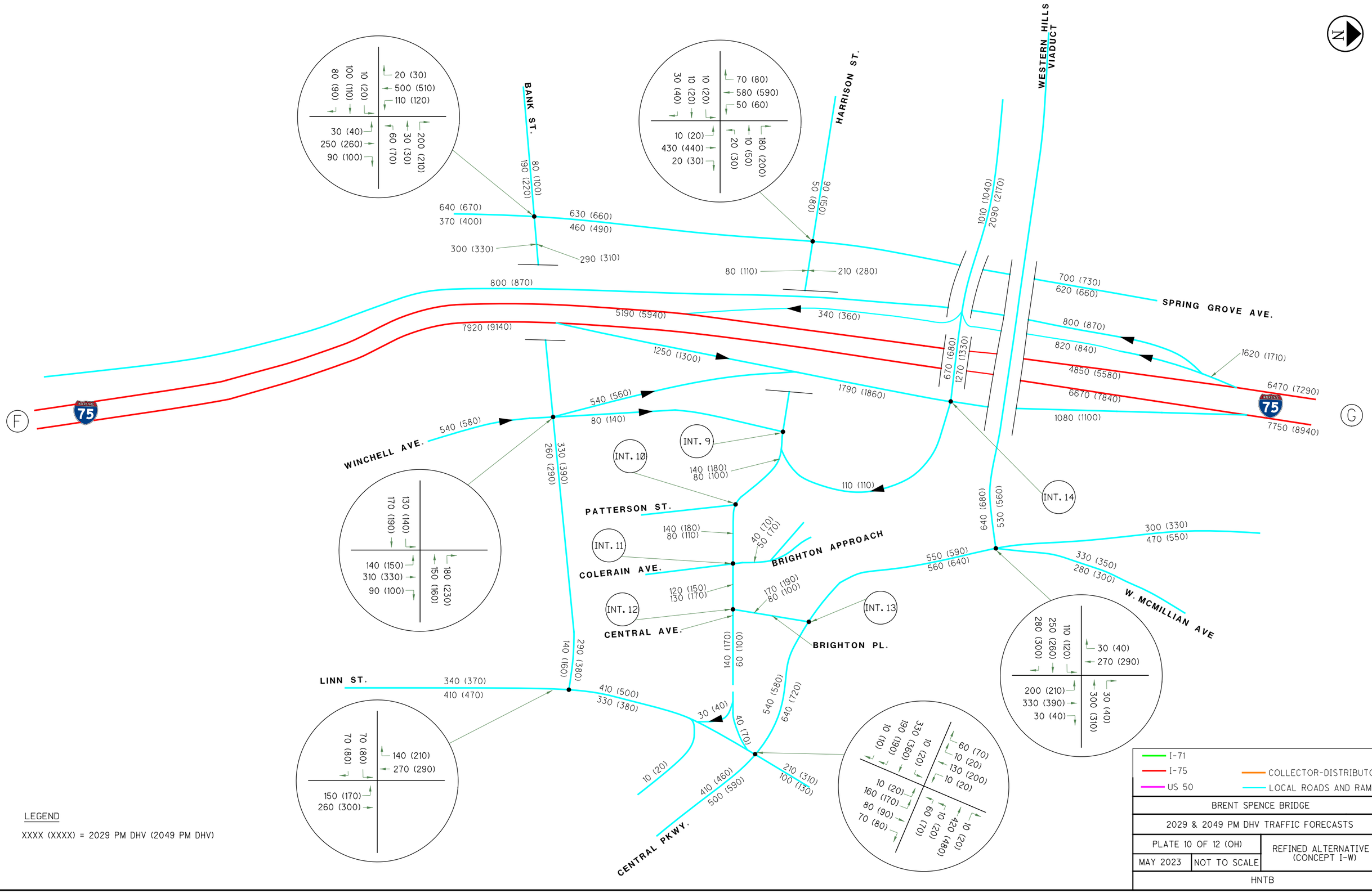
2029 & 2049 PM DHV TRAFFIC FORECASTS

PLATE 9 OF 12 (OH)

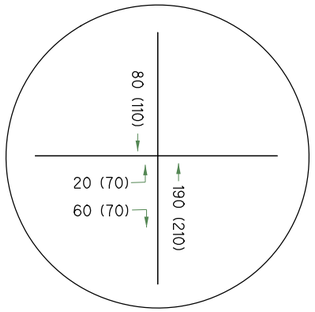
REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB

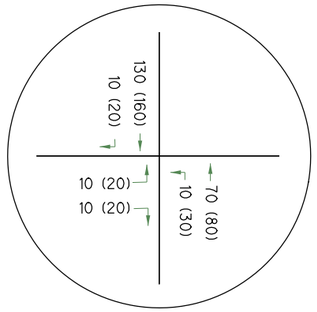

BANK ST.
HARRISON ST.
WESTERN HILLS VIADUCT
SPRING GROVE AVE.
WINCHELL AVE.
PATTERSON ST.
COLERAIN AVE.
BRIGHTON APPROACH
CENTRAL AVE.
BRIGHTON PL.
W. MCMILLIAN AVE
LINN ST.
CENTRAL PKWY.
INT. 9
INT. 10
INT. 11
INT. 12
INT. 13
INT. 14
INTERSTATE 75
F
G
N
640 (670)
370 (400)
630 (660)
460 (490)
300 (330)
290 (310)
80 (100)
190 (220)
80 (110)
210 (280)
90 (100)
50 (80)
800 (870)
5190 (5940)
7920 (9140)
340 (360)
1250 (1300)
1790 (1860)
1010 (1040)
2090 (2170)
670 (680)
1270 (1330)
700 (730)
620 (660)
800 (870)
820 (840)
4850 (5580)
6670 (7840)
1080 (1100)
1620 (1710)
6470 (7290)
7750 (8940)
540 (560)
540 (580)
80 (140)
330 (390)
260 (290)
140 (180)
80 (100)
110 (110)
640 (680)
530 (560)
300 (330)
470 (550)
550 (590)
560 (640)
330 (350)
280 (300)
140 (160)
290 (380)
140 (170)
60 (100)
120 (150)
130 (170)
170 (190)
80 (100)
340 (370)
410 (470)
410 (500)
330 (380)
30 (40)
40 (70)
540 (580)
640 (720)
10 (20)
410 (460)
500 (590)
210 (310)
100 (130)
LEGEND
XXXX (XXXX) = 2029 PM DHV (2049 PM DHV)
I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
BRENT SPENCE BRIDGE
2029 & 2049 PM DHV TRAFFIC FORECASTS
PLATE 10 OF 12 (OH)
REFINED ALTERNATIVE I (CONCEPT I-W)
MAY 2023
NOT TO SCALE
HNTB

INT. 9



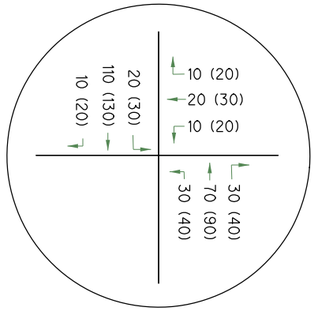
HARRISON STREET & WINCHELL AVENUE

INT. 10



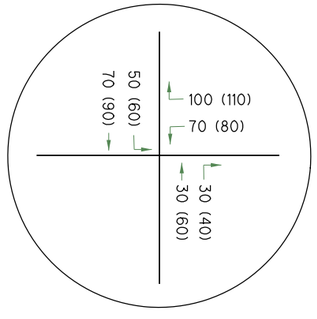
HARRISON STREET & PATTERSON STREET

INT. 11



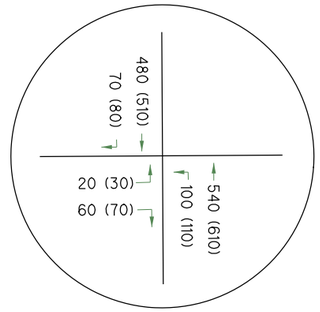
HARRISON STREET & COLERAIN AVENUE

INT. 12



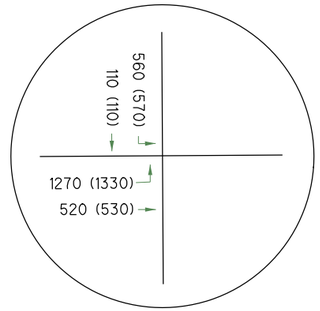
CENTRAL AVENUE & BRIGHTON PLACE

INT. 13



BRIGHTON PLACE & CENTRAL PARKWAY

INT. 14



WESTERN HILLS VIADUCT & WINCHELL RAMP

LEGEND

XXXX (XXXX) = 2029 PM DHV (2049 PM DHV)

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

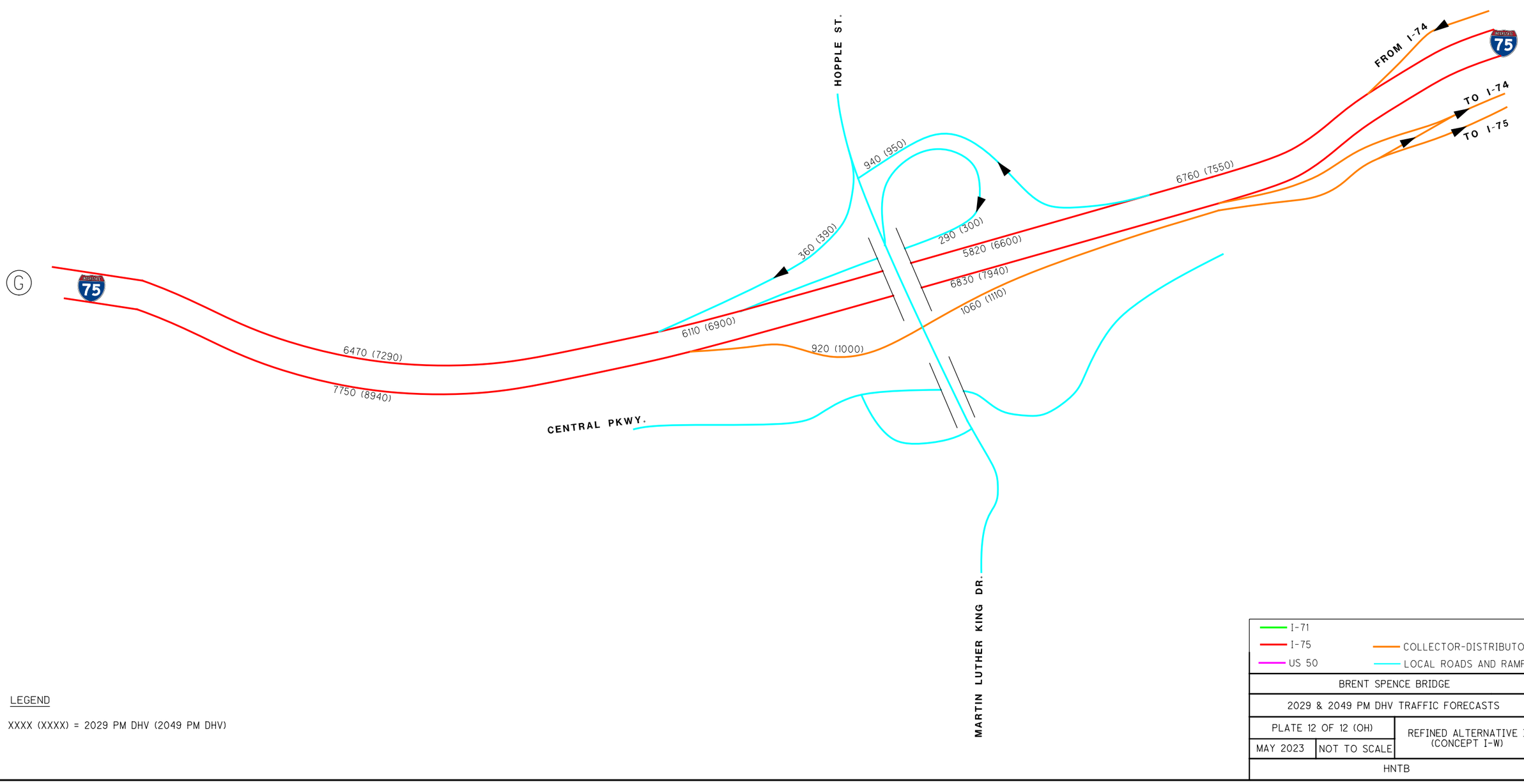
2029 & 2049 PM DHV TRAFFIC FORECASTS

PLATE 11 OF 12 (OH)

MAY 2023 | NOT TO SCALE

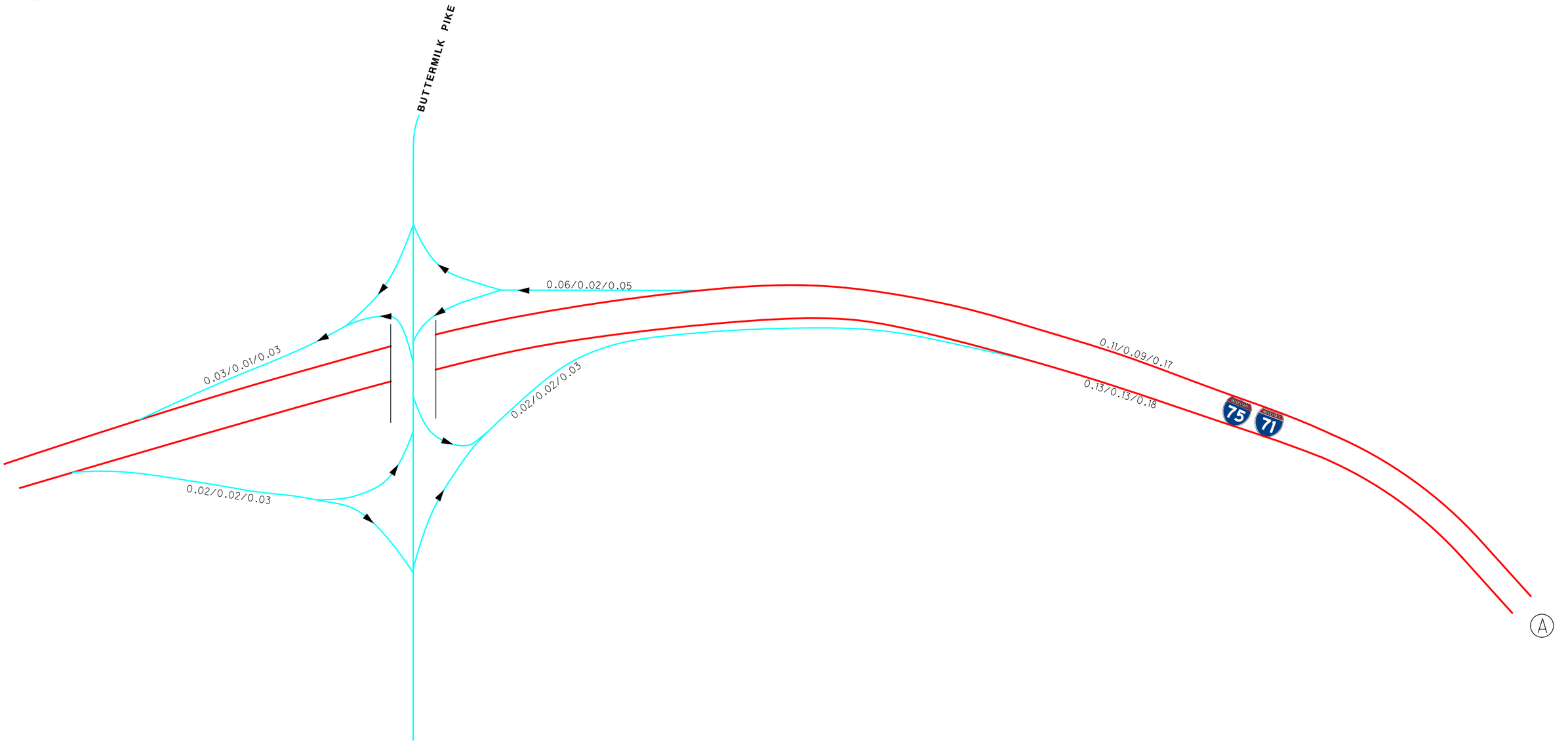
REFINED ALTERNATIVE I (CONCEPT I-W)

HNTB


N
G
75
HOPPLE ST.
FROM I-74
75
TO I-74
TO I-75
940 (950)
360 (390)
290 (300)
6760 (7550)
5820 (6600)
6830 (7940)
1060 (1110)
6110 (6900)
920 (1000)
6470 (7290)
7750 (8940)
CENTRAL PKWY.
MARTIN LUTHER KING DR.
LEGEND
XXXX (XXXX) = 2029 PM DHV (2049 PM DHV)
I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
BRENT SPENCE BRIDGE
2029 & 2049 PM DHV TRAFFIC FORECASTS
PLATE 12 OF 12 (OH)
REFINED ALTERNATIVE I
(CONCEPT I-W)
MAY 2023
NOT TO SCALE
HNTB

NOTE

BUTTERMILK DDI CONFIGURATION IS NOT INCLUDED IN BRENT SPENCE BRIDGE PROJECT.



LEGEND

0.X/0.X/0.X = AM TD / PM TD / T24

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

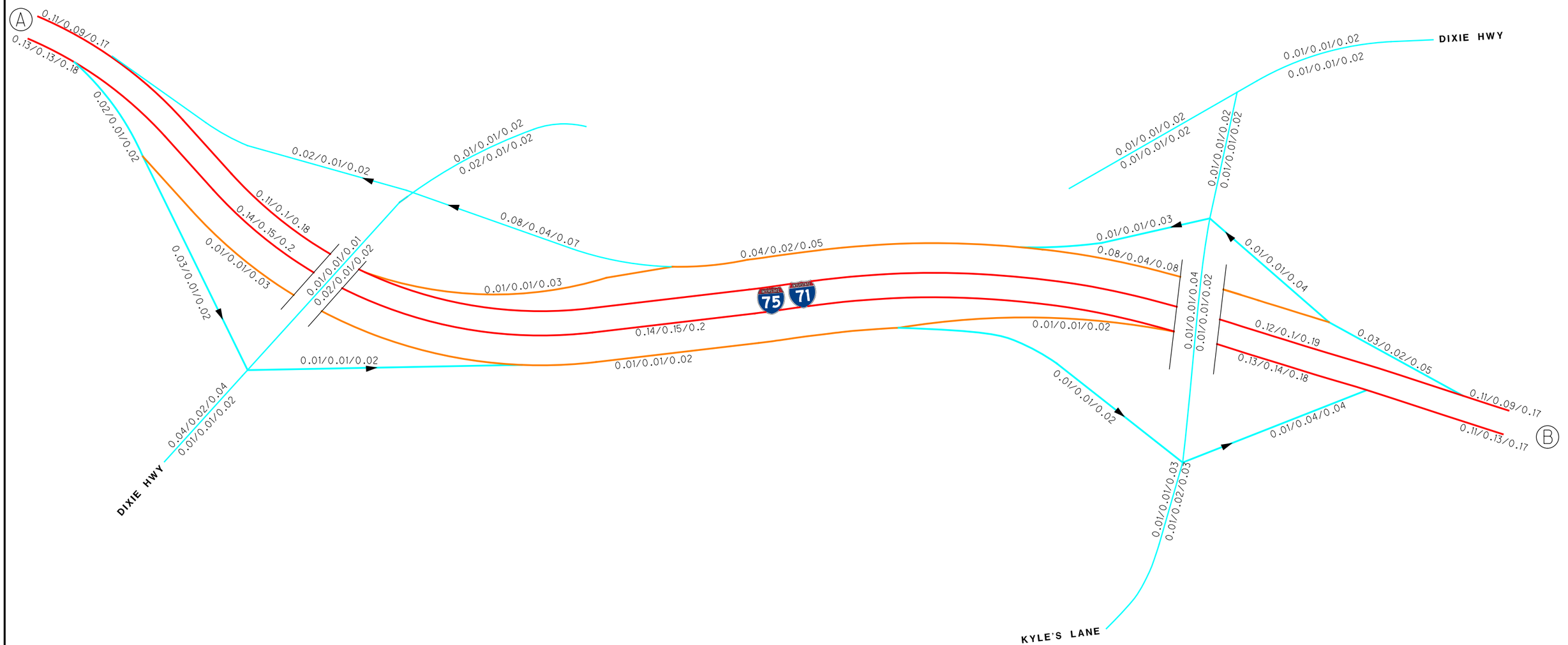
TRUCK FACTORS

PLATE 1 OF 9 (KY)

REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB



BRENT SPENCE BRIDGE

TRUCK FACTORS

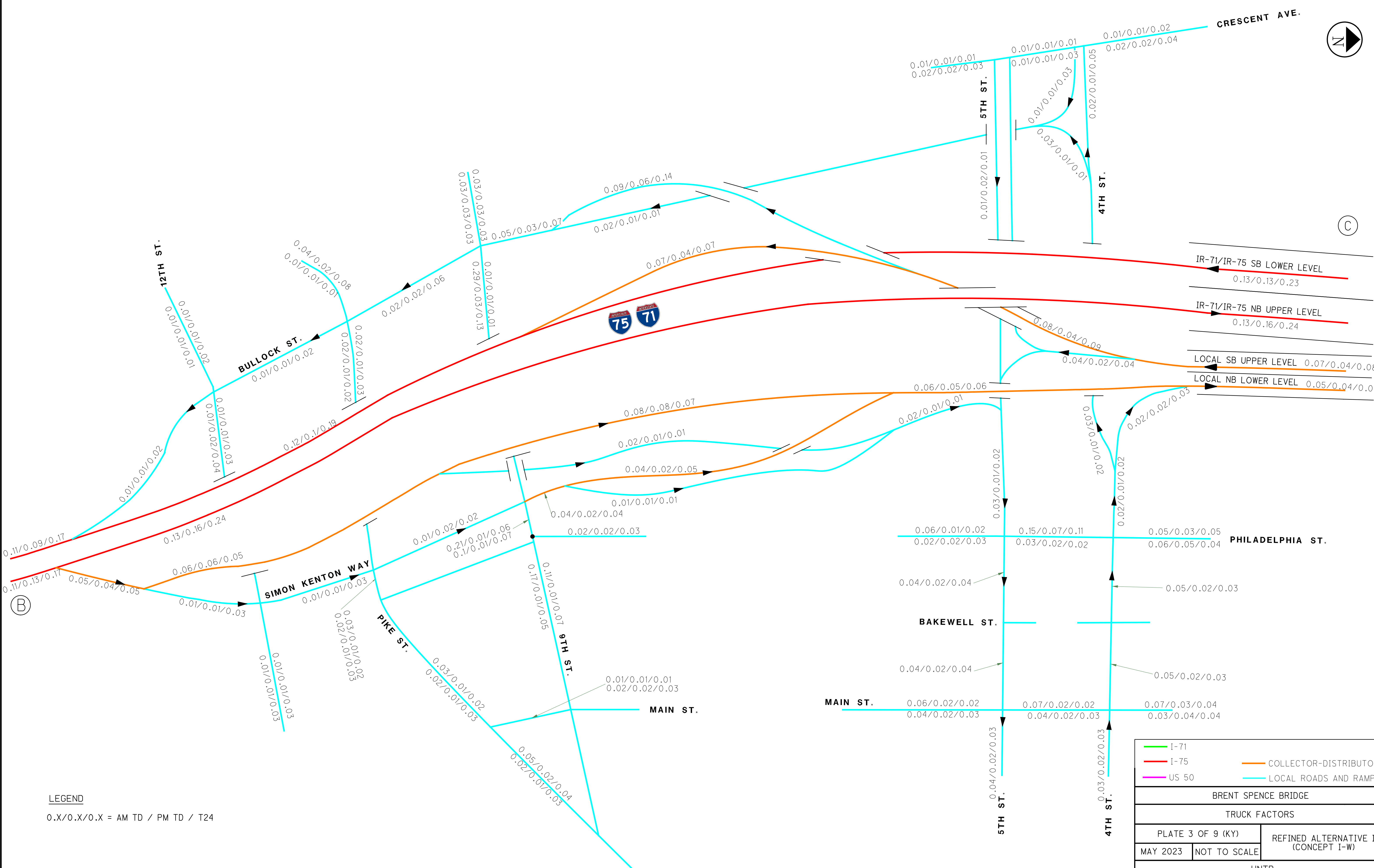
PLATE 2 OF 9 (KY)

REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023

NOT TO SCALE

HNTB


CRESCENT AVE.
5TH ST.
4TH ST.
12TH ST.
BULLOCK ST.
SIMON KENTON WAY
PIKE ST.
9TH ST.
MAIN ST.
PHILADELPHIA ST.
BAKEWELL ST.
IR-71/IR-75 SB LOWER LEVEL
0.13/0.13/0.23
IR-71/IR-75 NB UPPER LEVEL
0.13/0.16/0.24
LOCAL SB UPPER LEVEL 0.07/0.04/0.08
LOCAL NB LOWER LEVEL 0.05/0.04/0.06
0.11/0.09/0.17
0.11/0.13/0.17
0.13/0.16/0.24
0.12/0.1/0.19
0.07/0.04/0.07
0.08/0.08/0.07
0.06/0.05/0.06
0.09/0.06/0.14
0.05/0.03/0.07
0.02/0.01/0.01
0.02/0.02/0.06
0.01/0.01/0.02
0.06/0.06/0.05
0.05/0.04/0.05
0.01/0.01/0.03
0.04/0.02/0.05
0.02/0.01/0.01
0.01/0.01/0.01
0.04/0.02/0.04
0.02/0.02/0.03
0.08/0.04/0.09
0.04/0.02/0.04
0.02/0.01/0.01
0.02/0.02/0.03
0.06/0.01/0.02
0.02/0.02/0.03
0.15/0.07/0.11
0.03/0.02/0.02
0.05/0.03/0.05
0.06/0.05/0.04
0.05/0.02/0.03
0.06/0.02/0.02
0.04/0.02/0.03
0.07/0.02/0.02
0.04/0.02/0.03
0.07/0.03/0.04
0.03/0.04/0.04
0.01/0.01/0.01
0.02/0.02/0.03
0.01/0.02/0.02
0.21/0.01/0.06
0.1/0.01/0.07
B
C
N
I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

LEGEND

0.X/0.X/0.X = AM TD / PM TD / T24

BRENT SPENCE BRIDGE

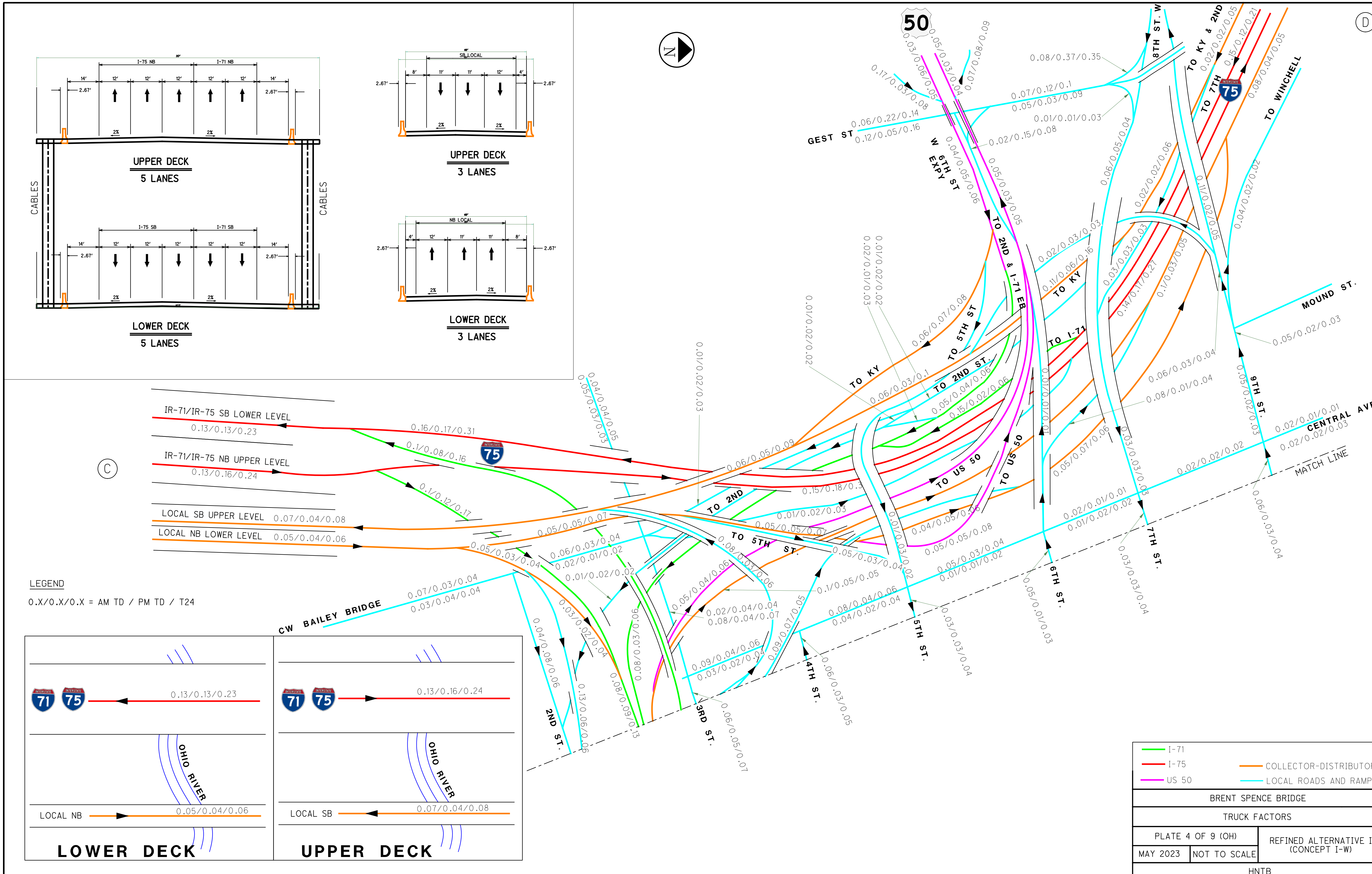
TRUCK FACTORS

PLATE 3 OF 9 (KY)

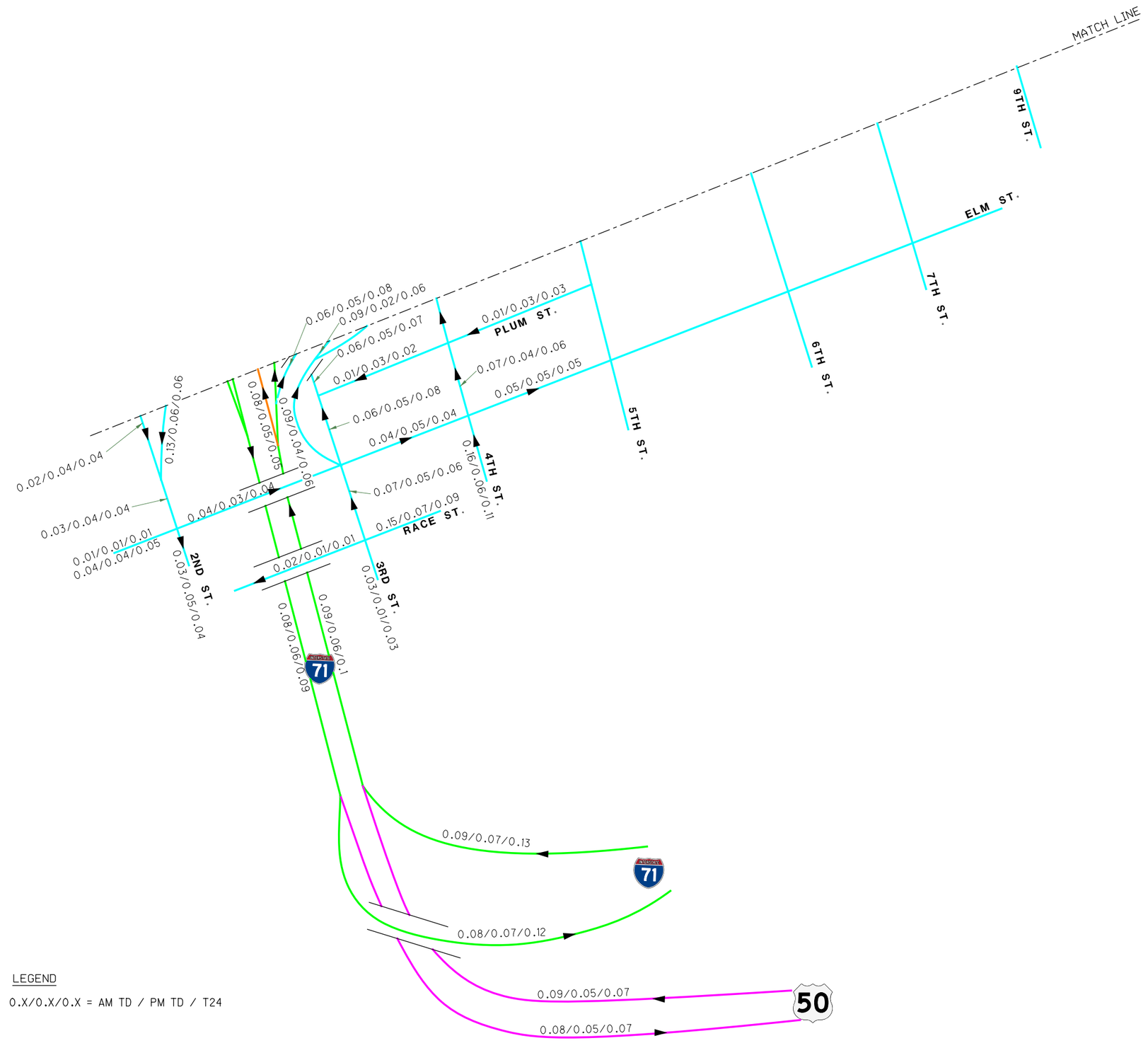
REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB



BRENT SPENCE BRIDGE	
TRUCK FACTORS	
PLATE 4 OF 9 (OH)	REFINED ALTERNATIVE I (CONCEPT I-W)
MAY 2023 / NOT TO SCALE	
HNTB	



LEGEND

0.X/0.X/0.X = AM TD / PM TD / T24

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

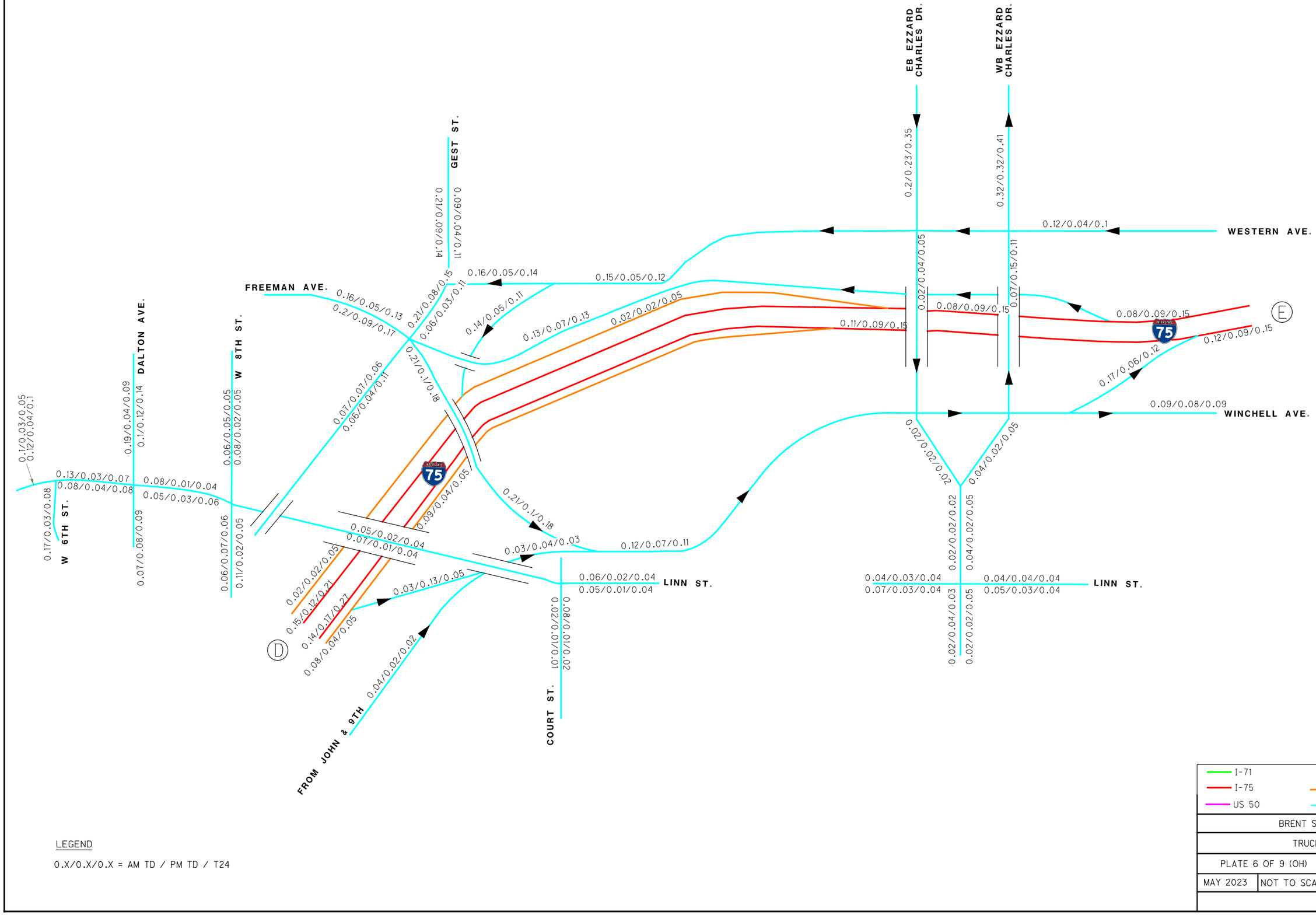
TRUCK FACTORS

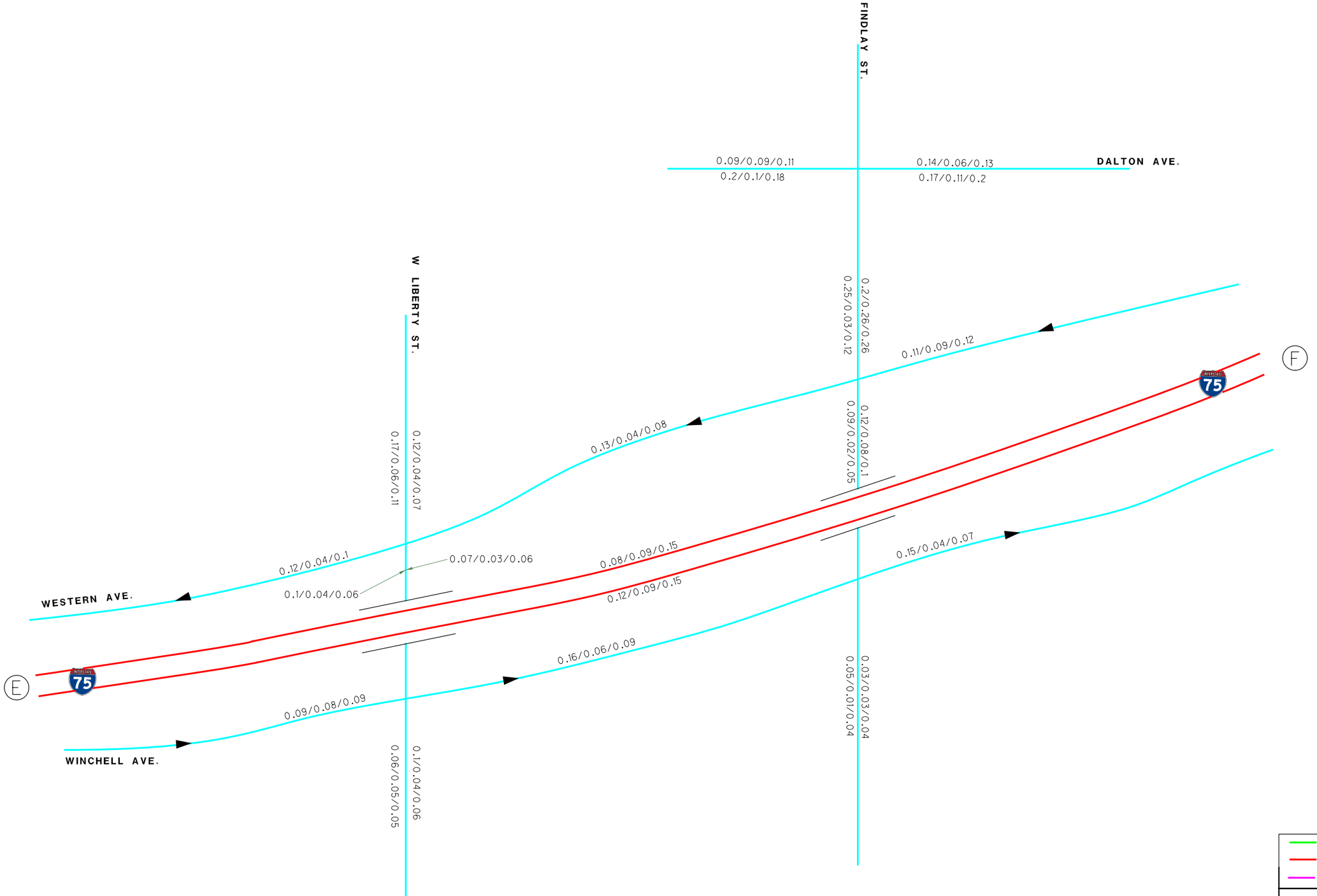
PLATE 5 OF 9 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB


EB EZZARD CHARLES DR.
WB EZZARD CHARLES DR.
WESTERN AVE.
WINCHELL AVE.
LINN ST.
LINN ST.
FREEMAN AVE.
GEST ST.
DALTON AVE.
W 8TH ST.
W 6TH ST.
COURT ST.
FROM JOHN & 9TH
0.2/0.23/0.35
0.32/0.32/0.41
0.12/0.04/0.1
0.02/0.04/0.05
0.07/0.15/0.11
0.08/0.09/0.15
0.11/0.09/0.15
0.08/0.09/0.15
0.12/0.09/0.15
0.17/0.06/0.12
0.09/0.08/0.09
0.16/0.05/0.14
0.15/0.05/0.12
0.21/0.09/0.14
0.09/0.04/0.11
0.16/0.05/0.13
0.2/0.09/0.17
0.21/0.08/0.15
0.06/0.03/0.11
0.14/0.05/0.11
0.13/0.07/0.13
0.02/0.02/0.05
0.21/0.1/0.18
0.07/0.07/0.06
0.06/0.04/0.11
0.09/0.04/0.05
0.21/0.1/0.18
0.03/0.04/0.03
0.12/0.07/0.11
0.06/0.02/0.04
0.05/0.01/0.04
0.03/0.13/0.05
0.04/0.02/0.02
0.05/0.02/0.04
0.07/0.01/0.04
0.02/0.02/0.05
0.15/0.12/0.21
0.14/0.17/0.27
0.08/0.04/0.05
0.02/0.02/0.02
0.04/0.02/0.05
0.04/0.03/0.04
0.07/0.03/0.04
0.04/0.04/0.04
0.05/0.03/0.04
0.02/0.04/0.03
0.02/0.02/0.05
0.08/0.01/0.02
0.02/0.01/0.01
0.1/0.03/0.05
0.12/0.04/0.1
0.13/0.03/0.07
0.08/0.04/0.08
0.08/0.01/0.04
0.05/0.03/0.06
0.17/0.03/0.08
0.19/0.04/0.09
0.1/0.12/0.14
0.07/0.08/0.09
0.06/0.05/0.05
0.08/0.02/0.05
0.06/0.07/0.06
0.11/0.02/0.05
I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
LEGEND
0.X/0.X/0.X = AM TD / PM TD / T24
BRENT SPENCE BRIDGE
TRUCK FACTORS
PLATE 6 OF 9 (OH)
REFINED ALTERNATIVE I (CONCEPT I-W)
MAY 2023
NOT TO SCALE
HNTB



LEGEND

0.X/0.X/0.X = AM TD / PM TD / T24

I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS

BRENT SPENCE BRIDGE

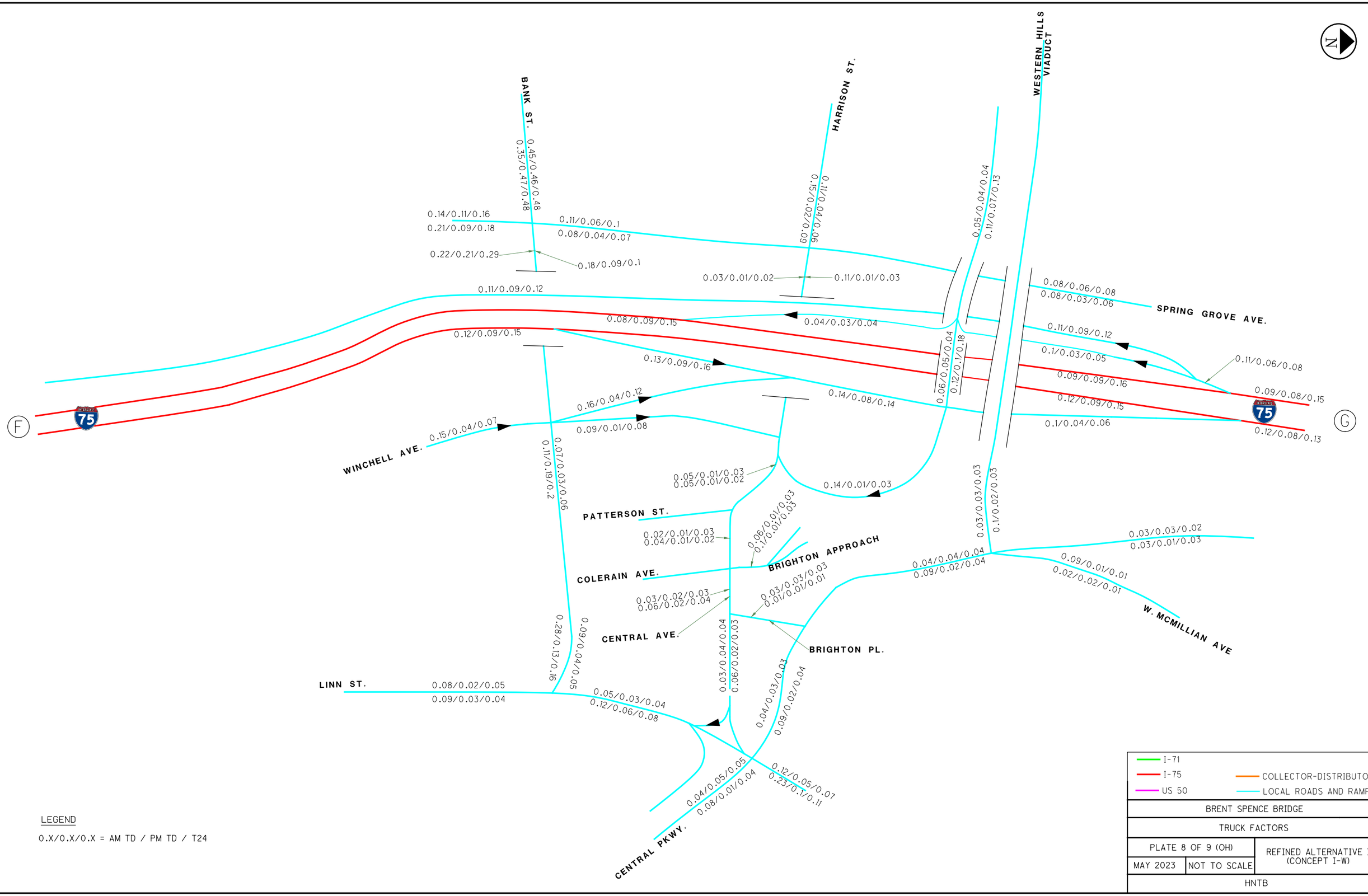
TRUCK FACTORS

PLATE 7 OF 9 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W)

MAY 2023 | NOT TO SCALE

HNTB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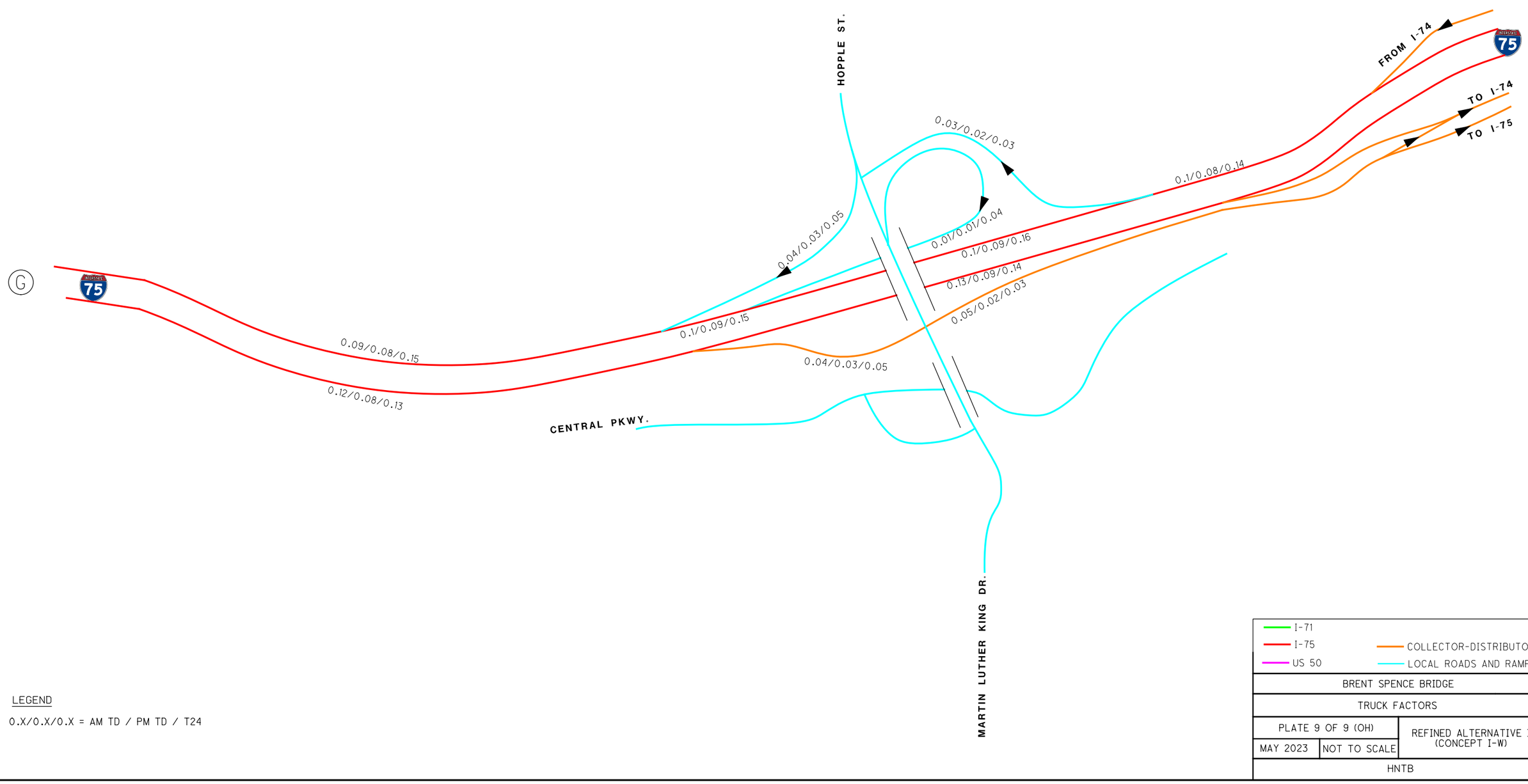
I-71
I-75
US 50
COLLECTOR-DISTRIBUTOR
LOCAL ROADS AND RAMPS
LEGEND
0.X/0.X/0.X = AM TD / PM TD / T24
BRENT SPENCE BRIDGE
TRUCK FACTORS
PLATE 8 OF 9 (OH)
MAY 2023
NOT TO SCALE
REFINED ALTERNATIVE I (CONCEPT I-W)
HNTB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CENTRAL PKWY.
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LEGEND
0.X/0.X/0.X = AM TD / PM TD / T24

Appendix F:
IMS Addendum Traffic Operations Analysis

BRENT SPENCE BRIDGE CORRIDOR PROJECT

BUILD INNOVATIONS TRAFFIC OPERATIONS ANALYSIS

NOVEMBER 7, 2025

TEAM KENTUCKY TRANSPORTATION CABINET

Ohio Department of Transportation

HNTB

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APPENDICES

Revision Record

Rev #	Date	Description	ODOT Approval	KYTC Approval	FHWA Approval
0.1	8/22/2025	Final IMS Addendum Submittal to FHWA			
0.2	11/7/2025	The report text has been updated in response to FHWA comments regarding methodology and the summary of results. No changes were made to the operations analysis as part of this update. The sections with text updates include: - Section 4.2.1 Model Overview - Section 4.2.2 Traffic Demand - Section 4.3 Required Number of Model Runs - Section 5.1.3 I-71/75 Southern Terminus - Section 5.3.1 I-71/75 Travel Time - Section 5.3.3 Hypothesis Testing for I-71/75 Travel Time - Section 5.3.5 Intersection Level of Service - Appendix A: TransModeler Calibration Report has minor updates to clarify the critical time intervals and the modeling of roadway grades in TransModeler.			

1. INTRODUCTION

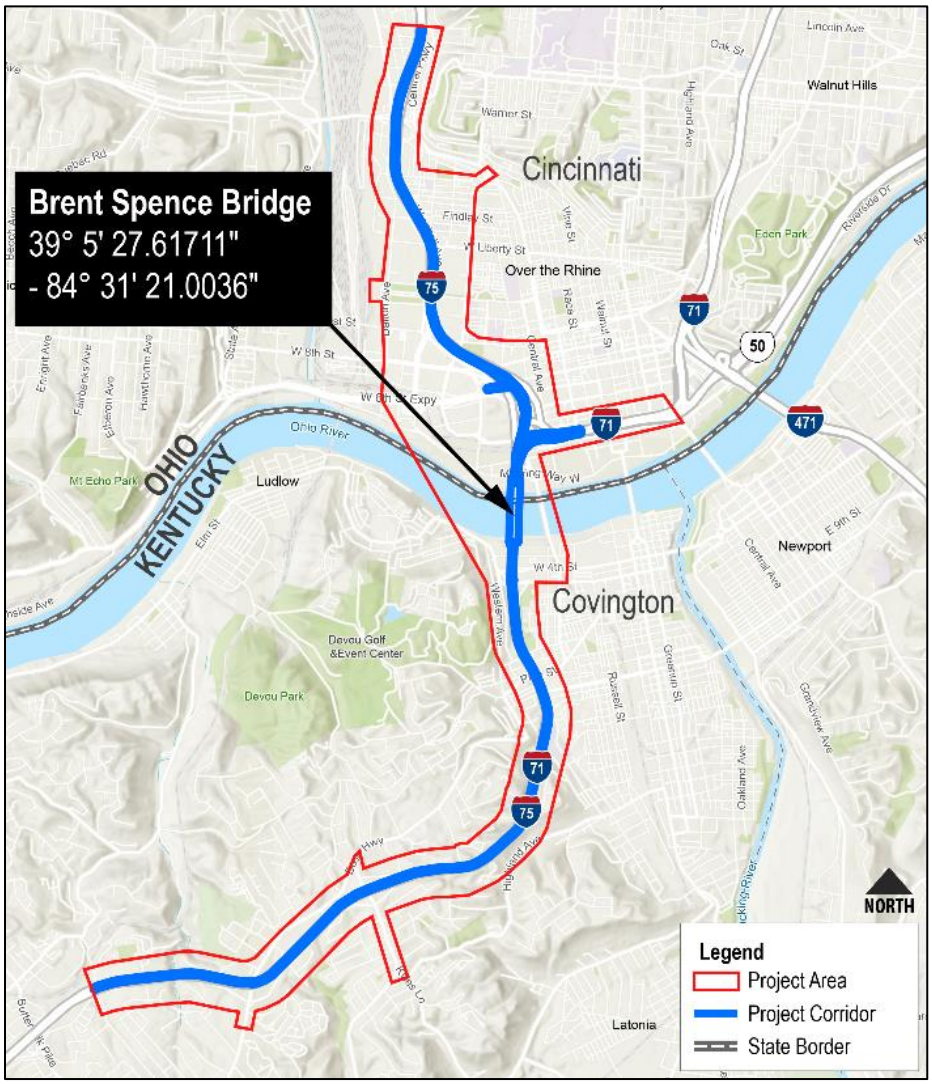
The purpose of this *Interchange Modification Study (IMS) Addendum Traffic Operations Analysis* is to update the IMS (December 2023) for the Brent Spence Bridge (BSB) Corridor Project. This report provides information on the design and traffic analysis performed for the Brent Spence Bridge Corridor since 2022. This includes an analysis of the previously preferred Refined Alternative I (Concept I-W) and the revised preferred alternative called Build Innovations.

This addendum will assist the Kentucky Transportation Cabinet (KYTC), the Ohio Department of Transportation (ODOT), and FHWA in assessing the differences in impacts on traffic operations between Refined Alternative I (Concept I-W) and Build Innovations. The analysis will provide the justification and documentation necessary to substantiate that the refinements incorporated into the Build Innovations alternative will result in acceptable traffic operations and will not degrade traffic operations compared to the previously preferred alternative. The acceptability of the operations was assessed using a variety of traffic metrics, including traffic delays, level of service, volume throughput, and travel times. Standard thresholds from FHWA, ODOT, and KYTC were used to compare results against the desired criteria.

2. TRAFFIC OPERATIONS STUDY AREA

The BSB Project Area is shown in **Figure 1.** The study area incorporates the highway corridors shown in blue and labeled as the Project Corridor - interstate I-71 and I-75 corridors, including geospatial data for the bridge crossing, and a portion of US 50 West and US 50 East (along I-71, east of I-75). The southern limit of the project corridor is approximately 5,000 feet south of the Dixie Highway interchange on I-71/I-75 in Fort Mitchell at Kentucky milepost 188.0. The northern boundary of the project corridor is about 1,500 feet north of the Western Hills Viaduct (WHV) Interchange on I-75 in Cincinnati at Ohio milepost 2.5. The eastern and western limits of the project corridor follow the existing alignment of I-75, a major throughway for local and regional mobility within the Greater Cincinnati/Northern Kentucky region. Locally, I-75 connects to I-71, I-74, I-275, and US Route 50. The BSB provides an interstate connection carrying I-71 and I-75 over the Ohio River, providing a critical link along the national I-75 corridor stretching from Florida to Michigan.

Figure 1: BSB Project Area



The limits of the TransModeler analysis are shown in **Figure 2**, which extends further along the I-71/ I-75 corridor than the BSB project corridor to include the I-275 Interchange on the south and the I-74/I-75 Interchange on the north. The model consists of mainline, ramps, ramp terminals, and arterial intersections. The traffic operations analysis study area does not use the full TransModeler limits but instead includes the first adjacent interchange beyond the BSB project corridor to include Buttermilk Pike to the south of the US 25/Dixie Highway interchange and Hopple Street to the north of the WHV interchange.

Figure 2: TransModeler Project Limits

3. PROJECT BACKGROUND

On October 14, 2004, KYTC and ODOT recognized the need to improve the BSB corridor. They formally agreed to jointly develop and deliver a project to replace the existing BSB over the Ohio River. Key characteristics of the BSB corridor are described below:

- The corridor comprises 7.8 miles of I-71 and I-75, located within portions of Ohio and Kentucky.
- The BSB carries both I-71 and I-75 over the Ohio River.
- The BSB opened in 1963 and was initially designed to carry 80,000 vehicles per day (VPD) with current traffic volumes of 160,000 VPD.

3.1 Existing Conditions

The BSB was not designed to accommodate the current or future daily traffic volume. The design of the I-71 and I-75 facilities does not meet current design standards for numerous features, including lane widths, shoulder widths, horizontal and vertical clearances, left-hand entrances and exits, and horizontal and vertical geometry. For these reasons, the BSB project corridor experiences design deficiency and congestion-related crashes.

3.2 Purpose and Need

The BSB Project will improve the operational characteristics within the I-75 corridor for both local and through traffic. In the Greater Cincinnati/Northern Kentucky region, the I-75 corridor suffers from congestion and safety–related issues due to inadequate capacity to accommodate current traffic demand. Current travel trends show traffic bottlenecks at the Brent Spence Bridge, particularly northbound in the AM peak period and southbound in the PM peak period.

The purpose of the BSB Corridor Project is unchanged from what was presented in the approved May 2024 SEA/FONSI:

- Improve traffic flow and level of service;
- Improve safety;
- Correct geometric deficiencies; and
- Maintain connections to critical regional and national transportation corridors.

4. TRAFFIC ANALYSIS METHODOLOGY

The traffic operations analysis for this IMS addendum is evaluated using TransModeler traffic microsimulation modeling. The TransModeler models were developed following guidelines from the *ODOT Analysis and Traffic Simulation Manual: Traffic Simulation with TransModeler*[1]*, KYTC Microsimulation Guidelines*[2], FHWA Traffic Analysis Toolbox Volume III: Guidelines for Applying Microsimulation Modeling Software (2019 update)[3], and agreed upon calibration methodologies outlined in the BSB Traffic Methods and Assumption Memorandum. The Existing 2019 model was calibrated for 6-10 AM and 2-7 PM periods. The model duration and calibration parameters were maintained for modeling the future year. The future 2049 modeling is completed for Refined Alternative I (Concept I-W), and Build Innovations. The methodology for each of these models is described in the sections below.

4.1 Existing (2019) Calibration

The Existing 2019 model development procedures are outlined below. The TransModeler Calibration report includes the full details of the process and results, which are included in **Appendix A**.

2019 Existing Calibration Approach

1) Existing Model Network Development:
    a. It started with the Existing 2019 model prepared for the BSB value engineering study in 2022. This model was modified from a model developed by Caliper in 2020 for the Connected Autonomous Vehicle (CAV) analysis. The BSB model started with the network, but does not use the autonomous vehicles in the simulation. During the development of the value engineering model, the link grades were reviewed and updated to be consistent with the criteria outlined in the OATS manual.
    b. The TransModeler network was adjusted to match the IMS limits.
    c. Minor calibration adjustments were included from the value engineering model with changes to the local headway buffers.
    d. Models are developed with TransModeler 6.1.
2) Cluster Analysis
    a. A cluster analysis was completed using methodologies agreed upon by all stakeholders to determine a primary cluster for each peak period with a corresponding representative day.
    b. Data inputs include:
        i. I-71/I-75 Travel times collected by INRIX and available through the National Performance Management Research Data Set (NPMRDS)
        ii. Volume throughput on BSB
        iii. Precipitation
        iv. Crashes

[1] https://www.transportation.ohio.gov/working/engineering/roadway/studies-access-management/oats
[2] https://transportation.ky.gov/Planning/Documents/KYTC%20Microsimulation%20Guidelines.pdf
[3] https://ops.fhwa.dot.gov/publications/fhwahop18036/fhwahop18036.pdf

c. Analysis timeframe is May 28, 2019, to October 25, 2019

3) Volume Development
    a. As part of the value engineering study completed in 2022, the following steps were completed:
        i. Traffic counts from 2017 – 2021 were reviewed for the project corridor, and count target volume values were selected.
        ii. The selected traffic volumes were inputs in an origin-destination (O-D) matrix estimation.
        iii. Model periods were defined as 6:00-10:00 AM and 2:00-7:00 PM on a weekday to capture the full extent of peak period travel delays. Each model also includes a 30-minute warmup.
        iv. Existing O-D matrices were developed for three vehicle classes in 15-minute bins.
            1. Autos
            2. Single Unit Trucks
            3. Articulated Trucks
        v. Project-specific vehicle fleet information was developed for the project using traffic counts and recommendations from ODOT and KYTC manuals.
    b. For the IMS calibration update in 2023, the BSB throughput volume was established using the representative day identified in the cluster analysis. The O-D matrices were modified from the models created in 2022 to achieve travel time and volume throughput calibration targets.
    c. The volumes used for the Existing 2019 TransModeler calibration were also used to establish balanced peak hour volumes used within the certified traffic process to forecast opening year and design year traffic volumes.
4) Existing Model Calibration
    a. Cluster analysis was used to identify a representative day.
    b. The calibration methodology agreed upon by all stakeholders uses two measures of effectiveness (MOEs):
        i. I-71/I-75 travel time: Northbound and Southbound travel time between I-275 (southern study limit extents) and I-74 interchanges (northern study limit extents). This travel time is measured through the corridor's bottleneck at the BSB.
        ii. I-71/75 vehicle throughput at the BSB for both travel directions in the AM and PM peak periods. The AM northbound and PM southbound are the critical bottlenecks.

4.2 Alternative Evaluation

4.2.1 Model Overview

The year 2049 models were developed for Refined Alternative I (Concept I-W) and Build Innovations using TransModeler. Refined Alternative I (Concept I-W) model was developed for the IMS report approved in December 2023. This model has the same model limits, calibration parameters, and periods as the 2019 existing calibrated model. The model represents the roadway grades in the design following OATS guidelines, including grades greater than +-2%. The grades have an impact on the vehicle accelerations at steeper inclines. The alternative models also include truck-restricted lanes for SB I-71/75 in Kentucky between 9th Street and Kyles Lane, consistent with existing conditions. The Build Innovations model has some minor modifications to the previous model; the differences include the following:

- Network limits in Kentucky are expanded to assess a broader street grid surrounding the project that is impacted by Build Innovation design changes.
    - 3rd Street between Crescent Avenue and Johnson Street.
    - Johnson Street between 3rd Street and 5th Street.
- Model route choice uses stochastic equilibrium. This method is used instead of a deterministic shortest path to allow multi-paths between 3rd and 4th Street in Kentucky and between the new NB arterial and Central Avenue in Ohio. A volume validation spreadsheet with the model files is provided to compare the modeled peak hour to the certified traffic to ensure the model volumes are representative of the certified traffic. The difference in approach does not impact the underlying operational metrics reported by the TransModeler software. The following settings were used in the project DTA modeling:
    - Target Gap: 0.5%
    - Interval (min): 15
    - Path Update Threshold: 7.5%
    - Seed Demand: 75%
    - Seed Iteration: 10
    - Start Iteration: 1
    - Maximum Iterations: 200

The LOS for signalized intersections and freeway mainline segments are reported for the peak hour for each site and summarized in **Appendix B** (Refined Alternative I (Concept I-W)), and **Appendix C** (Build Innovations). Intersection LOS is based on travel delay, while the mainline LOS is based on roadway densities measured in passenger car equivalents per mile per lane. The LOS scale defined by the Highway Capacity Manual 6th Edition for intersections and mainlines is summarized in the tables below. The target LOS for this project is LOS D or better for freeways, D or better for intersections, and E or better for intersection approaches. The mainline LOS is calculated using the segment statistics instead of the LOS output in TransModeler. This approach is used for the Build Innovation update to be consistent with the previous IMS

analysis methodology. The TransModeler LOS calculations replicates the HCM methodology. A comparison of the two methods for calculating mainline LOS is provided with the model files for comparative purposes. The two methods show very similar results. The ramp terminal intersections are analyzed individually and use the LOS thresholds defined in **Table 1**.

Table 1: Intersection Level of Service Scale

LOS	Signalized Intersections		Roundabouts & Unsignalized Intersections	
	Low Delay (s)	High Delay (s)	Low Delay (s)	High Delay (s)
LOS A	0	10	0	10
LOS B	10	20	10	15
LOS C	20	35	15	25
LOS D	35	55	25	35
LOS E	55	80	35	50
LOS F	80	-	50	-

Table 2: Freeway Level of Service Scale

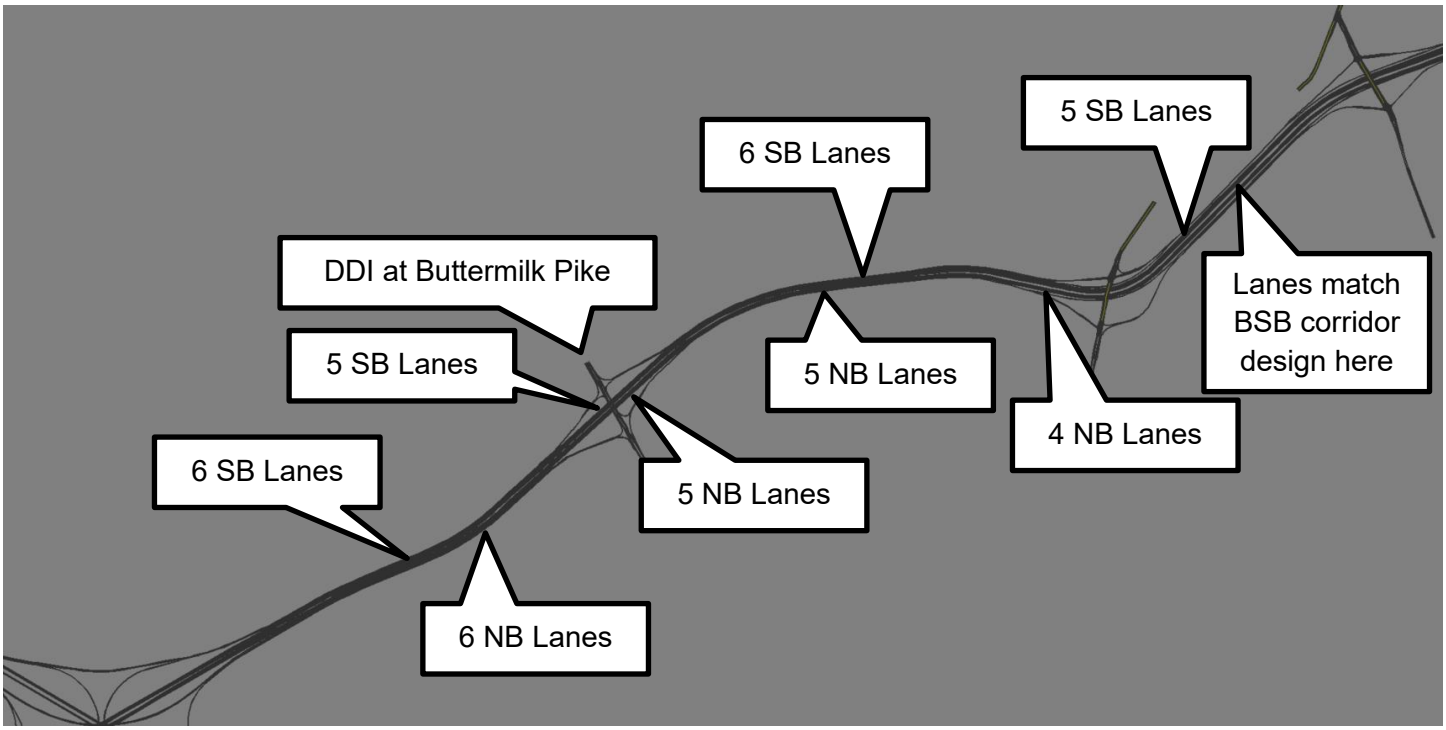
LOS	Basic Freeway Segments		Merge/Diverge Freeway Segments		Weave Freeway Segments	
	Low Density (pc/mi/ln)	High Density (pc/mi/ln)	Low Density (pc/mi/ln)	High Density (pc/mi/ln)	Low Density (pc/mi/ln)	High Density (pc/mi/ln)
LOS A	0	11	0	10	0	10
LOS B	12	18	11	20	11	20
LOS C	19	26	21	28	21	28
LOS D	27	35	29	35	29	35
LOS E	36	45	36	45	36	43
LOS F	46	-	46	-	44	-

Travel time metrics are reported for the I-71/I-75 corridor following guidelines from the FHWA TAT III alternative analysis guidelines. Each model's number of run requirements is checked to ensure the 95% confidence interval is achieved. **Section 4.3** provides additional details of this process.

The models are developed to consider roadway grades and design exceptions where applicable. The traffic signal timings are optimized to accommodate traffic demand within the project limits. Most arterial roadways have coordinated signals, with many of the signals in Cincinnati and Covington using pre-timed signals. The TransModeler assumes actuated traffic signals for some arterial intersections and many ramp terminal intersections outside downtown Cincinnati and Covington. Final traffic control recommendations will be evaluated in the final design. Turn lane storage recommendations consider the 2049 certified traffic and are assessed using the TransModeler 95th percentile queues and ODOT's storage length calculations.

A KYTC project for the I-71/I-75/I-275 Interchange[4] is currently in development. This project includes improvements to I-75 between Turfway Road and the southern limit of the BSB Corridor project, including the I-275 and Buttermilk Parkway Interchanges. The I-275 project is identified in the OKI Metropolitan Transportation Plan and is currently in the NEPA development phase at KYTC. These safety and capacity improvements are anticipated to be phased between 2027 and 2035, pending further authorization by the KY General Assembly. This project covers the southern extent of the BSB TransModeler limits. It is anticipated to be a significant bottleneck for the BSB corridor if the project still needs to be completed in 2049. A preliminary TransModeler analysis was conducted with the build alternatives and the existing condition between Buttermilk Pike and I-275. The study indicated significant queuing in the PM peak for SB I-71/I-75. In the AM peak, the queueing develops NB and prevents the full traffic demand from reaching the study limits. To account for the impacts of this project, the BSB model includes the current recommended configuration for I-71/I-75 between I-275 and Buttermilk Pike Interchange, including interchange reconfiguration of Buttermilk Pike Interchange. This improvement alleviates the southern traffic bottleneck, allowing the full forecasted traffic demand to reach the study area facilities. Results in this report reflect the removal of this bottleneck; external delays south of Dixie Hwy are expected if the I-71/I-75/I-275 project is not implemented. Additional analysis details for the southern terminus are included in **Section 5.1.3**. The assumed geometric modifications for the I-71/I-75 corridor at the southern terminus of the project are summarized in **Figure 3**. The BSB corridor design tapers the mainline lanes between Dixie Hwy and Kyles Lane to match existing conditions.

Figure 3: I-71/I-75 Improvements between I-275 and Dixie Hwy



[4] I-71/I-75 and I-275 Interchange Project Website: https://www.75275interchange.org/

4.2.2 Traffic Demand

Certified Traffic forecasts were developed for 2049 AM and PM design hour volumes. The project's Certified Traffic reports provide details on the development of these forecasts. The Existing calibrated TransModeler model represents 6-10 AM and 2-7 PM peak periods. To ensure the models are consistent with the certified design hour volumes and the calibrated 2019 model, the project team created proportioning factors to convert the certified traffic into 15-minute bins that blend data from the calibrated 2019 models and the certified traffic forecasts. This procedure results in 15-minute origin-destination matrices in three vehicle classifications used as inputs for the TransModeler analysis. The process follows these three steps to derive O-D matrices for each of the 2049 model scenarios:

1) Origin-Destination Matrix Estimation (ODME) was completed for the 1-hour AM and PM design hour traffic. The ODME uses the OKI travel demand model as a pattern O-D matrix. The outcome of this step is a 1-hour O-D matrix (auto and truck classifications) for the AM peak and one for the PM peak that replicates the forecasted traffic volumes at the roadway link and turn movements. The peak hours are 7:30-8:30 AM and 4:30-5:30 PM, as determined from the existing traffic counts, which were the basis for the design hour traffic forecasts. While calibrating the traffic demand of the existing model for the bottleneck dynamics on the Brent Spence Bridge, the traffic demand in the AM period was determined to peak at 7:15-8:15 AM, as reflected in the 15-minute proportioning figure. More details on the calibration are provided in **Appendix A**.
2) The 1-hour matrices are then proportioned into 15-minute loading matrices based on the traffic loading proportions from the Existing calibrated TransModeler models. The 15-minute proportions are shown in **Figure 4** (AM) and **Figure 5** (PM).
3) The truck matrices are then divided into single-unit (SU) and multi-unit (MU) classes using origin and destination proportions from the Existing calibrated TransModeler network. The final SU and MU truck matrices are derived using Fratar Factoring.

The result of the ODME is TransModeler traffic inputs consistent with the certified traffic volumes, OKI travel demand model, and temporal distributions from the Existing calibrated TransModeler model.

Figure 4: AM Period O-D Proportions

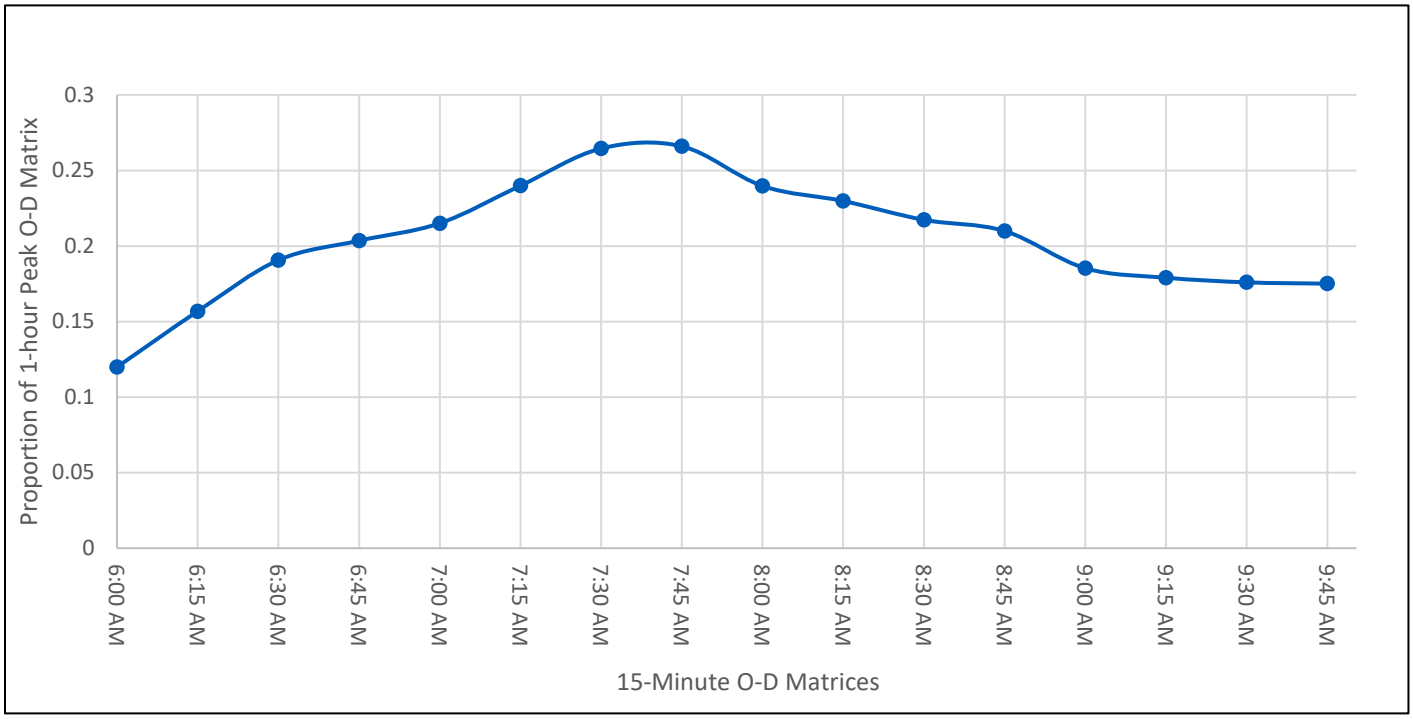
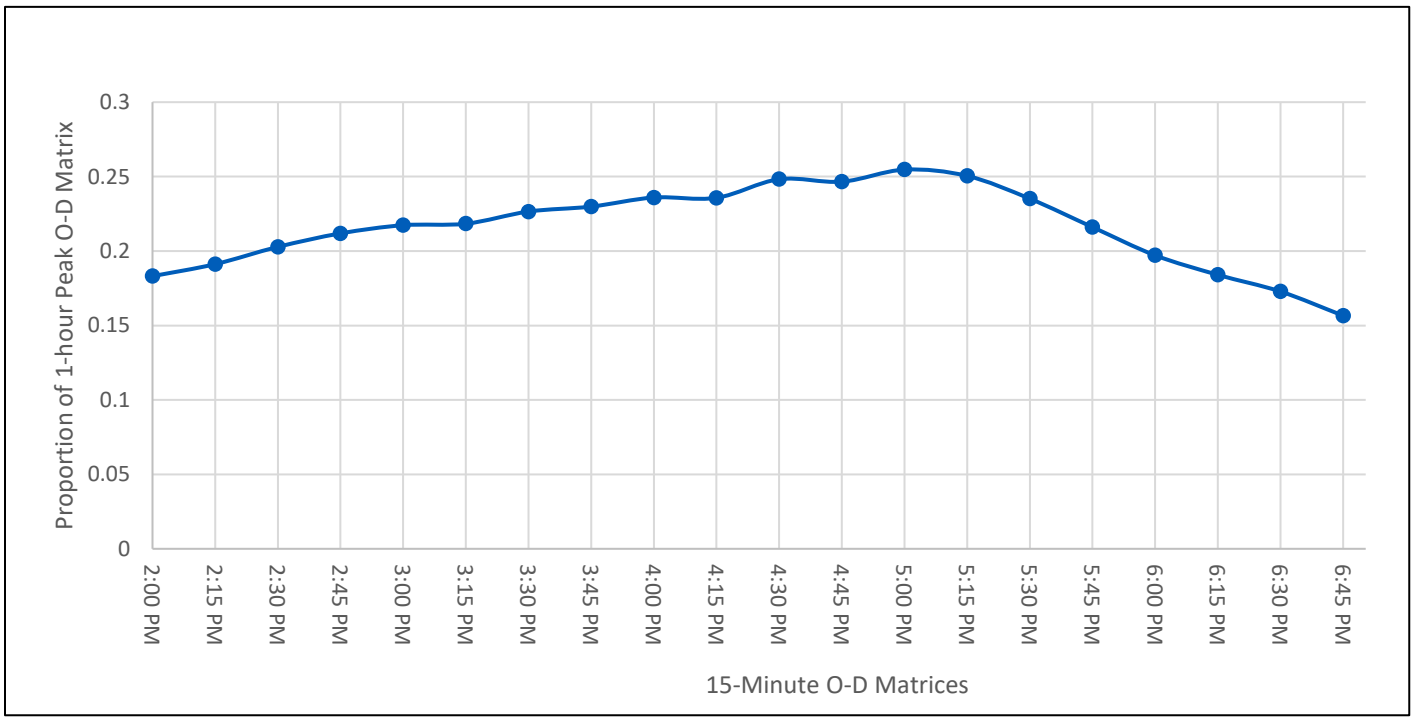


Figure 5: PM Period O-D Proportions



The Build Innovations model incorporates dynamic traffic assignment to assign traffic in areas that have multiple paths. This can result in a slight variation in traffic assignments compared to the certified traffic. However, the overall demand within the project limits is consistent with the traffic forecasts. During model development, a volume adjustment was required for I-71/75 southbound traffic exiting at 7th Street. The certified traffic forecasts assumed adequate roadway capacity for this movement, but the micro-level analysis revealed that the intersection of 7th Street and the northbound arterial could not accommodate the entire peak-hour volume without excessive queuing and operational breakdown, even after implementing feasible design improvements. The TransModeler network extents are limited and do not facilitate rerouting to different ramps. Because the macro-level travel demand model does not fully capture intersection-level operational constraints, manual rerouting was applied in TransModeler to reflect how motorists would likely respond under congested conditions. Drivers experiencing significant delays at 7th Street would reasonably divert to adjacent ramps serving similar destinations, as these routes offer lower expected travel times compared to remaining in the queue. To represent this behavior, 3% of the 7th Street exit ramp trips were reassigned to the Ezzard Charles intersections, and 5% to the 3rd Street intersection. This adjustment aligns with common practice when refining macro-level forecasts for micro-level operational analysis, ensuring the modeled traffic patterns reflect realistic route choice under congestion. The 8% traffic diversion for 7th Street resulted from a feedback loop between TransModeler and the traffic route adjustments.

4.3 Required Number of Model Runs

The ODOT and KYTC microsimulation guidelines recommend the use of ten model runs. FHWA TAT III 2019 provides guidelines for calculating the number of model runs based on field and model data. The agreed-upon approach for this project is to use an initial set of ten runs for the minimum number of run calculations and then confirm that ten runs achieve a 95% confidence interval. The following steps are applied for each peak period model scenario.

The minimum number of model runs is calculated using this formula:

$$N_{min} = \left(\frac{t_{n-1,95\%} s}{e\bar{x}}\right)^2$$

N_{min} : Required number of model runs
n : Number of initial model runs (10 runs)
$\bar{x}$, s : Mean and standard deviation of the initial runs
$t_{n-1, 95\%}$: t statistic for $n-1$ degrees of freedom and 95% confidence level
e : Tolerance error

The initial model replications (runs) are performed with random number seeds to prepare an initial output Measures of Effectiveness (MOEs) set. TAT III guidelines recommend performing four initial model runs, but ten initial runs were chosen to be consistent with state guidelines.

Tolerance error, *e*, is calculated for each MOE using the two (non-adjacent) critical periods, t_1 and t_2, for that measure. The maximum of the two calculated values is set as the tolerance error. The following formula is used to calculate the tolerance error:

$$e = \frac{t_{n-1,95\%}(\frac{s}{\sqrt{n}})}{\bar{x}}$$

e : Tolerance error
n : Number of field observations (days of the primary cluster)
$\bar{x}$, *s* : Mean and standard deviation of the critical time for the MOE.
$t_{n-1,\ 95\%}$: *t* statistic for *n-1* degrees of freedom and 95% confidence level

The minimum number of required model runs is calculated using the N_{min} formula, for all measures of interest. The minimum number of model runs (replications) is the maximum of the calculated N_{min} for all MOEs. **Table 3** presents the minimum number of required model runs for Refined Alternative I (Concept I-W) and Build Innovations, considering each measure of interest separately. The measure of interest includes the BSB volume throughput (NB and SB) and I-71/I-75 travel time (NB and SB). These four metrics are used for the existing model calibration.

Table 3: Minimum Number of Runs

Alternative	Peak	Measure of Interest			
		BSB Volume Northbound	BSB Volume Southbound	I-71/I-75 TT Northbound	I-71/I-75 TT Southbound
Refined Alternative I (Concept I-W)	**AM**	1.2	0.2	<0.1	<0.1
	PM	0.7	0.6	<0.1	<0.1
Build Innovations	**AM**	1.0	0.5	0.1	<0.1
	PM	0.7	0.3	<0.1	0.3

The results presented above show that the ten initial model runs are sufficient to meet the minimum number of run requirements (the required number of runs in **Table 3** is less than the ten initial runs), and no additional model replications are needed for Build Innovations and Refined Alternative I (Concept I-W). The required number of run calculations is very low, mostly below one run, because both build alternatives have stable travel conditions with no bottleneck at the Brent Spence Bridge and nearly free-flow travel time through the entire corridor. The minimum number of run calculations considered the first ten model simulation runs; no runs were discarded due to anomalies.

4.4 Test Differences in Alternative Analysis: Statistical Hypothesis Testing

One of the main objectives of this IMS addendum is to demonstrate that Build Innovations has acceptable operations and does not degrade operations compared to Refined Alternative I (Concept I-W). This objective is evaluated using a statistical hypothesis test that assesses the I-71/I-75 travel times for the alternatives. The average performance measures for the two alternatives, x_1 and x_2, are calculated to reflect the frequency of each travel condition using the weighted average formula shown below:

$$\bar{x}_j = \frac{\sum_{i=1}^{C}(x_i * n_i)}{\sum n_i}$$

Where:
$\bar{x}_j$: Weighted average of measure for alternative *j*
i : Cluster ID
C : Total number of clusters
x_i : Average performance measure estimate across all random number runs (i.e., $N_{\min}$) for Cluster *i*
n_i : Number of days in Cluster *i*

$$s_j^2 = \frac{\sum_{i=1}^{C}\left(x_i * \bar{x}_j\right)^2}{C}$$

s_j^2 = Variance of measure for alternative *j*

Pooled variance:

$$s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{(n_1 + n_2 - 2)}$$

$$t_{calculated} = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{s_p^2(\frac{1}{n_1} + \frac{1}{n_2})}}$$

Hypothesis test:
Null hypothesis, H_0: $\mu_1 \geq \mu_2$
Alternative hypothesis, H_1: $\mu_1 < \mu_2$
if $t_{calculated} \leq t_{n_1+n_2-2,95\%}$, reject H_0 and accept H_A. Otherwise, we do not have enough evidence to reject H_0.

Section 5.3.3 includes two hypothesis tests to compare the peak direction travel times for Build Innovations compared to Refined Alternative I (Concept I-W). The peak travel directions are NB I-71/I-75 in the AM peak period and SB I-71/I-75 in the PM peak period.

5. TRAFFIC OPERATIONS ANALYSIS

The traffic operational comparison of Refined Alternative I (Concept I-W) and Build Innovations is based on traffic simulation analyses performed using Caliper's TransModeler platform. Travel time and LOS metrics are reported for intersections and the freeway mainline segments. The analysis focuses on AM and PM peak period operations for the 2049 design year. The corridor-wide operational results for Refined Alternative I (Concept I-W) and Build Innovations are discussed in this section. LOS Schematics for total intersection LOS and freeway segments are summarized in **Appendix B** and **Appendix C**. The report includes tabular summaries of intersection LOS for all scenarios and approach LOS for Build Innovations. A more detailed summary of Build Innovation intersection results by lane group is presented in **Appendix D.** These tables include delay, LOS, and a comparison of the 95th percentile queues compared to the storage provided.

The traffic operations analysis aims to demonstrate the Build Innovations alternative provides acceptable traffic operations. For comparison, the previously preferred alternative - Refined Alternative I (Concept I-W) – is also evaluated. Operational acceptability was assessed using a combination of a visual review in TransModeler, LOS summaries for intersections and freeway segments, travel time data, 95th percentile queue lengths, and volume throughputs across the I-71/75 Ohio River bridges.

The acceptability is generally determined using the following criteria:

- **Level of Service:**
    - LOS D or better for freeways
    - LOS D or better for intersections
    - LOS E or better for intersection approaches
- **Queue Lengths:** 95th percentile queues must remain within available storage lanes
- **Travel Times:** Freeway mainline travel times should approximate free-flow conditions
- **Volume Throughput:** Traffic volumes on I-71/75 should not be constrained by bottlenecks

Existing corridor constraints and design limitations may justify exceptions to the operational standards outlined above. The traffic operations analysis identifies locations where performance falls outside the project's operational targets.

5.1 Refined Alternative I (Concept I-W) Operational Results

5.1.1 AM Peak Period

For the existing condition, inbound Cincinnati traffic is the primary source of traffic delays in the AM Period, with significant traffic delays for NB I-71/75 in Kentucky and SB I-75 north of the BSB. These traffic delays are reduced for Refined Alternative I (Concept I-W) with the proposed freeway capacity improvements. TransModeler screen captures of the AM peak are shown below in **Figure 6** and **Figure 7**.

The other noteworthy change with Refined Alternative I (Concept I-W) is the ramp modifications in downtown Cincinnati. These changes include removing the SB I-75 exit ramp to 5th Street. With this ramp removed, additional traffic utilizes the 7th Street and 2nd Street ramps, which have the highest traffic demand in the AM peak period. As modeled in TransModeler, these ramps and ramp terminal intersections operate with an acceptable level of service.

Figure 6: Refined Alternative I (Concept I-W) 2049 AM Peak – Kentucky

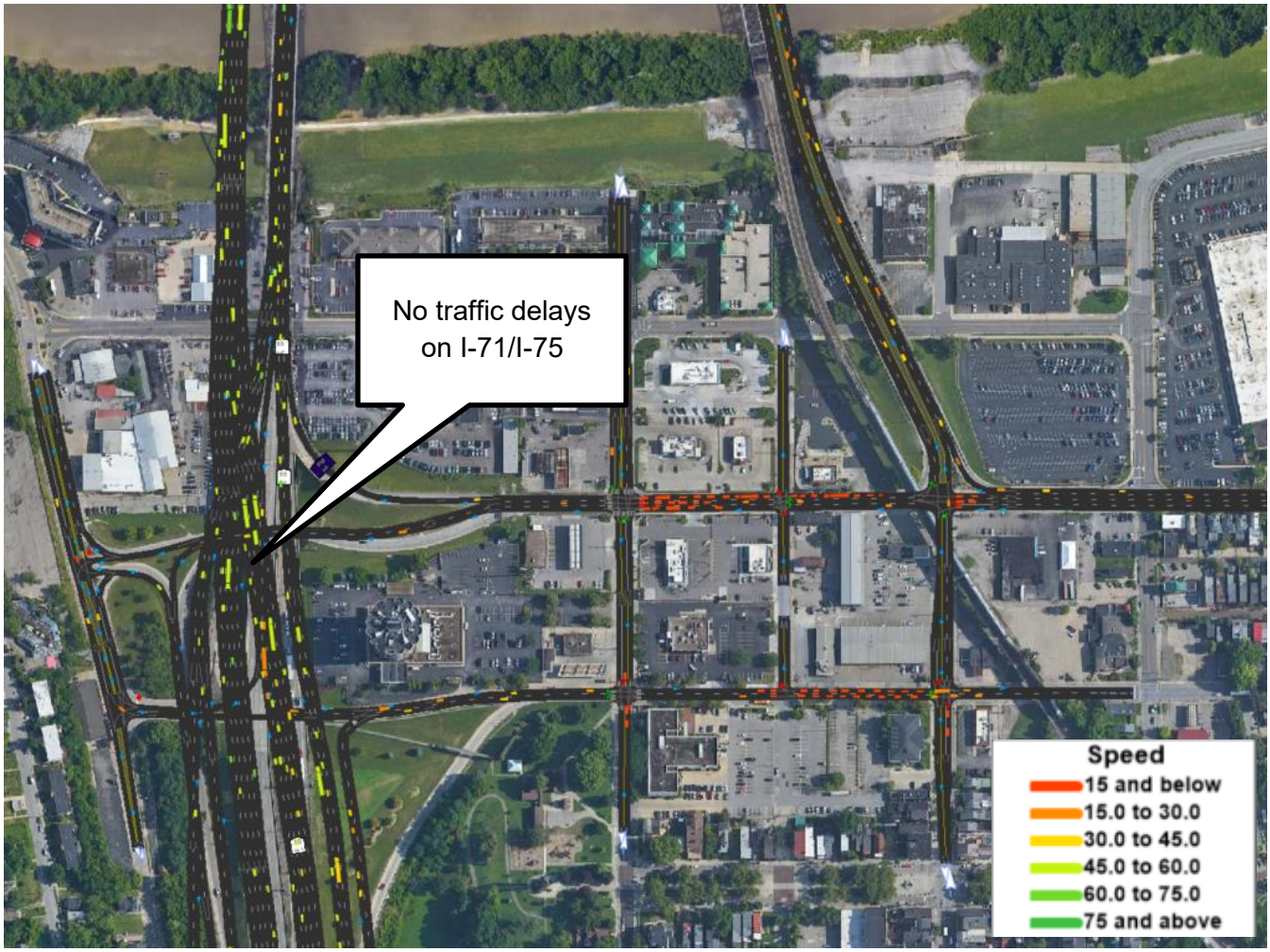
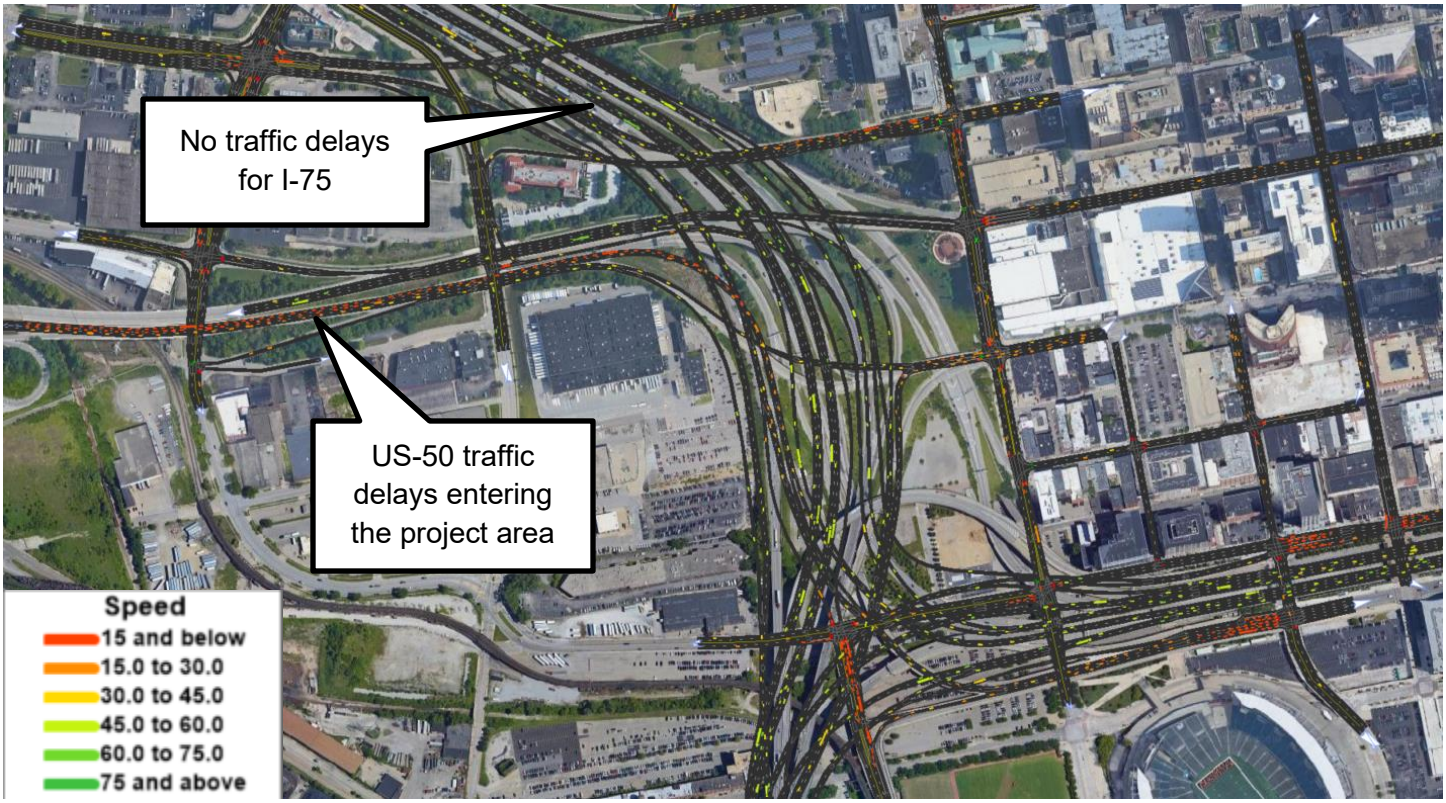


Figure 7: Refined Alternative I (Concept I-W) 2049 AM Peak – Ohio



5.1.2 PM Peak Period

For the existing condition, outbound Cincinnati traffic is the primary source of delays in the PM period, with significant traffic delays for SB I-71/75 in Kentucky and Ohio. These traffic delays are removed with the proposed freeway improvements for Refined Alternative I (Concept I-W). TransModeler screen captures for the PM peak are shown in **Figure 8** and **Figure 9**. One of the notable differences between existing and Refined Alternative I (Concept I-W) is the removal of the 4th Street entrance ramp in Ohio and the proposed 3rd Street (east of Central) entrance ramp. This change in access impacts how traffic accesses NB I-75 from downtown Cincinnati. The PM peak modeling, which has the highest traffic demand for this movement, indicates that 3rd Street and Central Avenue intersections maintain acceptable traffic operations with the traffic pattern changes.

An additional operation condition in all scenarios is the 5% grade on I-71/I-75 between 12th Street and Kyles Lanes. As shown in the TransModeler image in **Figure 8**, vehicles climbing the hill have reduced speeds. Still, these reduced speeds are isolated and do not impact the overall operations of the freeway system.

Figure 8: Refined Alternative I (Concept I-W) 2049 PM Peak – Kentucky

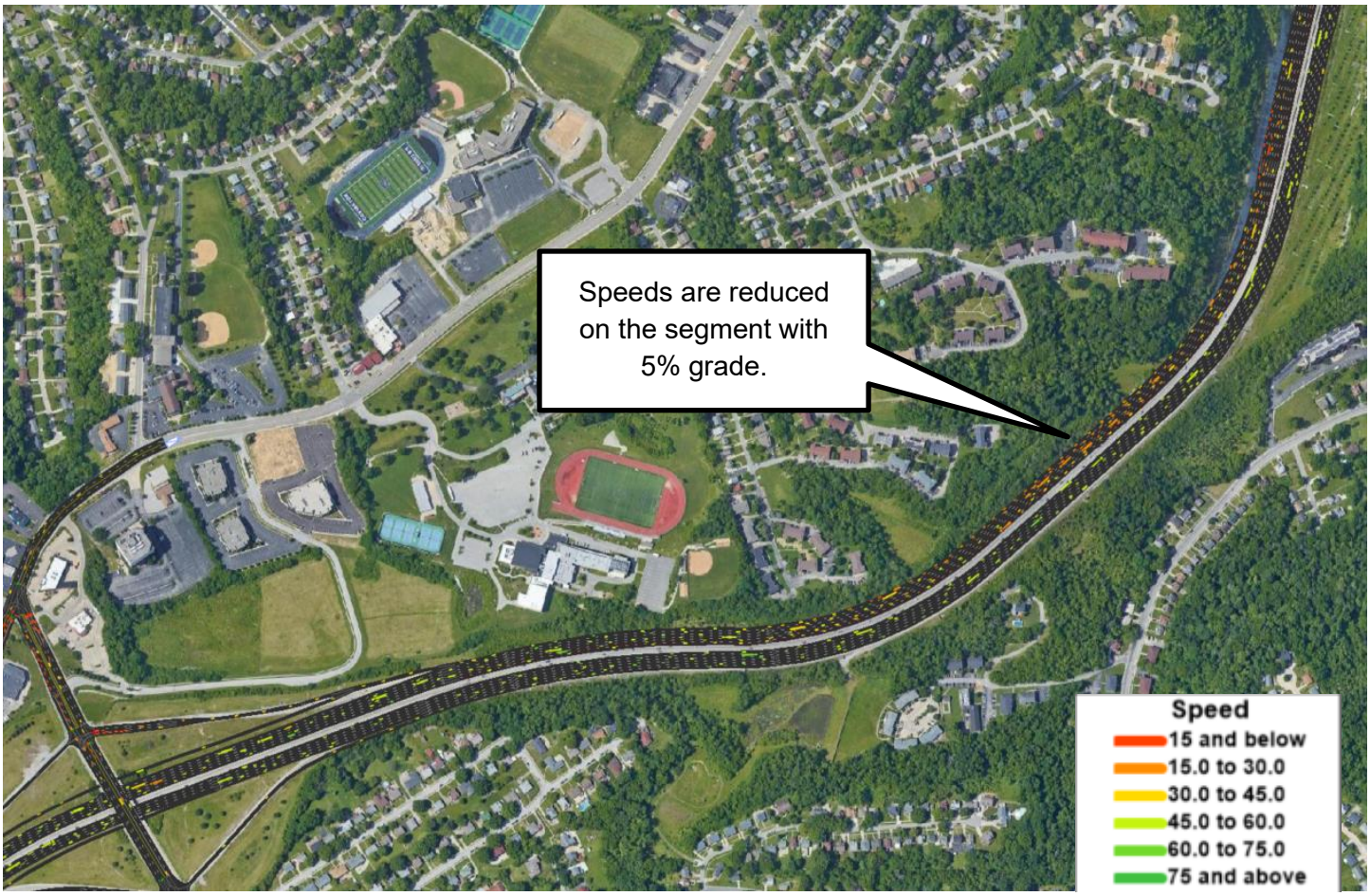
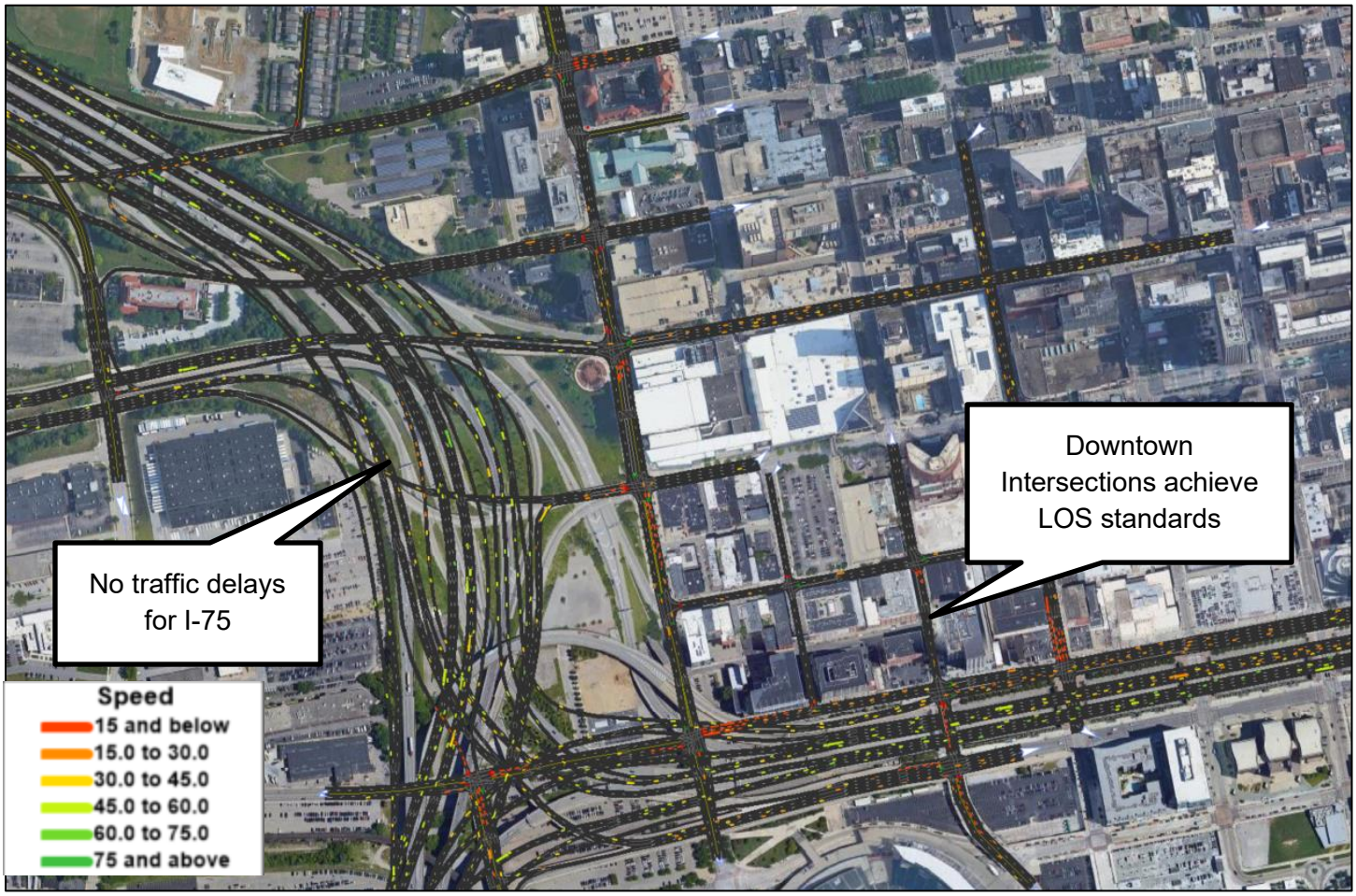


Figure 9: Refined Alternative I (Concept I-W) 2049 PM Peak – Ohio

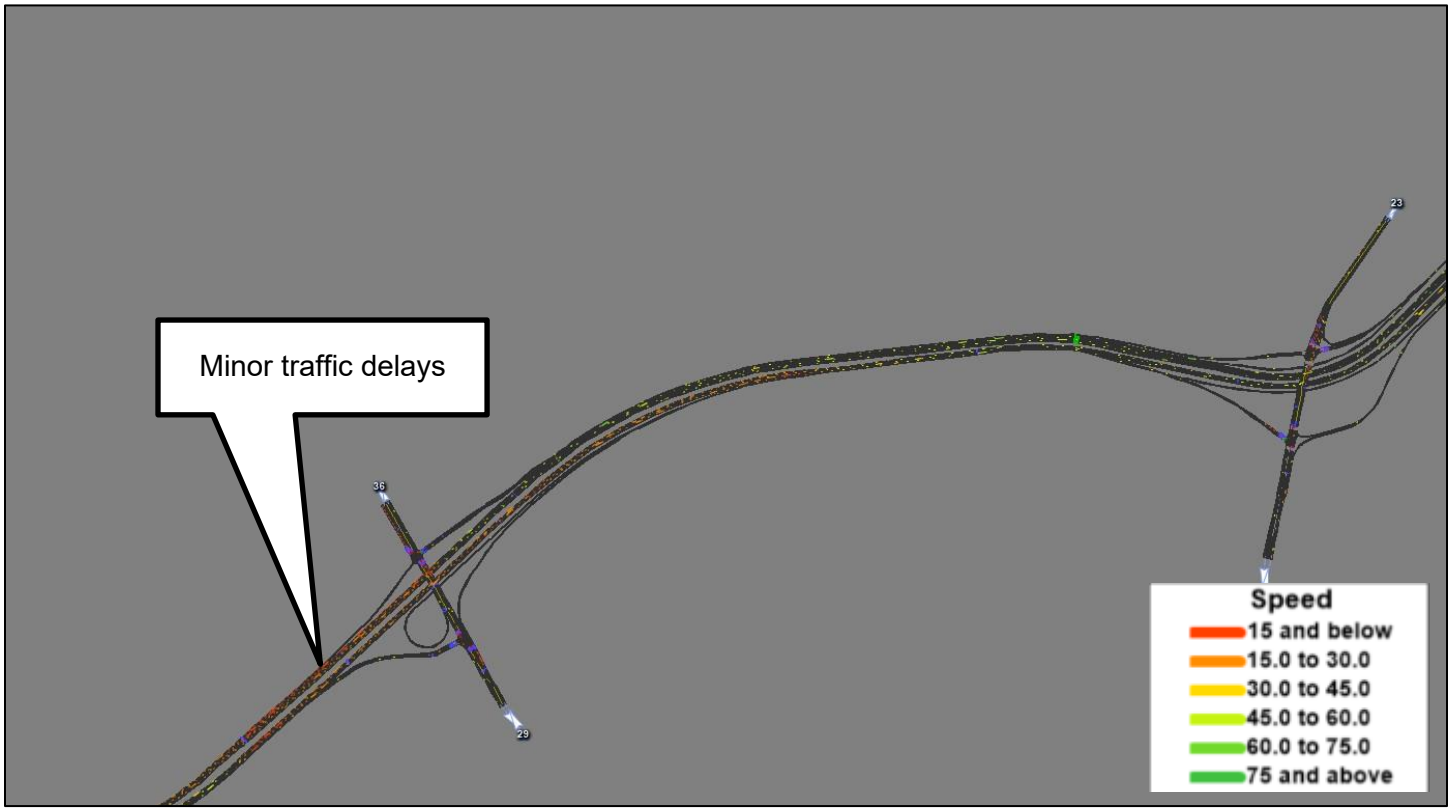


5.1.3 I-71/I-75 Southern Terminus

The 2049 operations analysis assumes the completion of the I-275 project. This project includes improvements to I-75 between Turfway Road and the southern limits of the BSB Corridor project, including the I-275 and Buttermilk Parkway Interchanges. The I-275 project is identified in the OKI Metropolitan Transportation Plan and is currently in the NEPA development phase at KYTC. These safety and capacity improvements are anticipated to be phased between 2027 and 2035, pending funding authorization by the KY General Assembly.

A sensitivity analysis was completed to evaluate the impact of an incomplete I-275 project on the I-71/I-75 corridor. A BSB opening day analysis using the AM and PM 2029 certified traffic volumes was evaluated with TransModeler using existing roadway geometry on I-71/-75 at the southern project terminus. Overall, the operations are acceptable for I-71/I-75 during the opening year, except for minor queuing during the PM peak at Buttermilk Pike, as shown in **Figure 10**.

Figure 10: PM 2029 Opening Year Analysis



The same design scenario was also tested using 2049 volumes; this is the worst-case scenario as the I-275 project is anticipated to be completed before 2049. With 2049 traffic, there is more significant queueing, as shown in **Figure 11** (AM Peak) and **Figure 12** (PM Peak). The PM peak is the most significant for the BSB corridor, with traffic slowdowns between Buttermilk Pike and 12th Street in Kentucky. The AM Northbound queues extend beyond the I-275 Interchange.

Figure 11: AM 2049 – Sensitivity Analysis

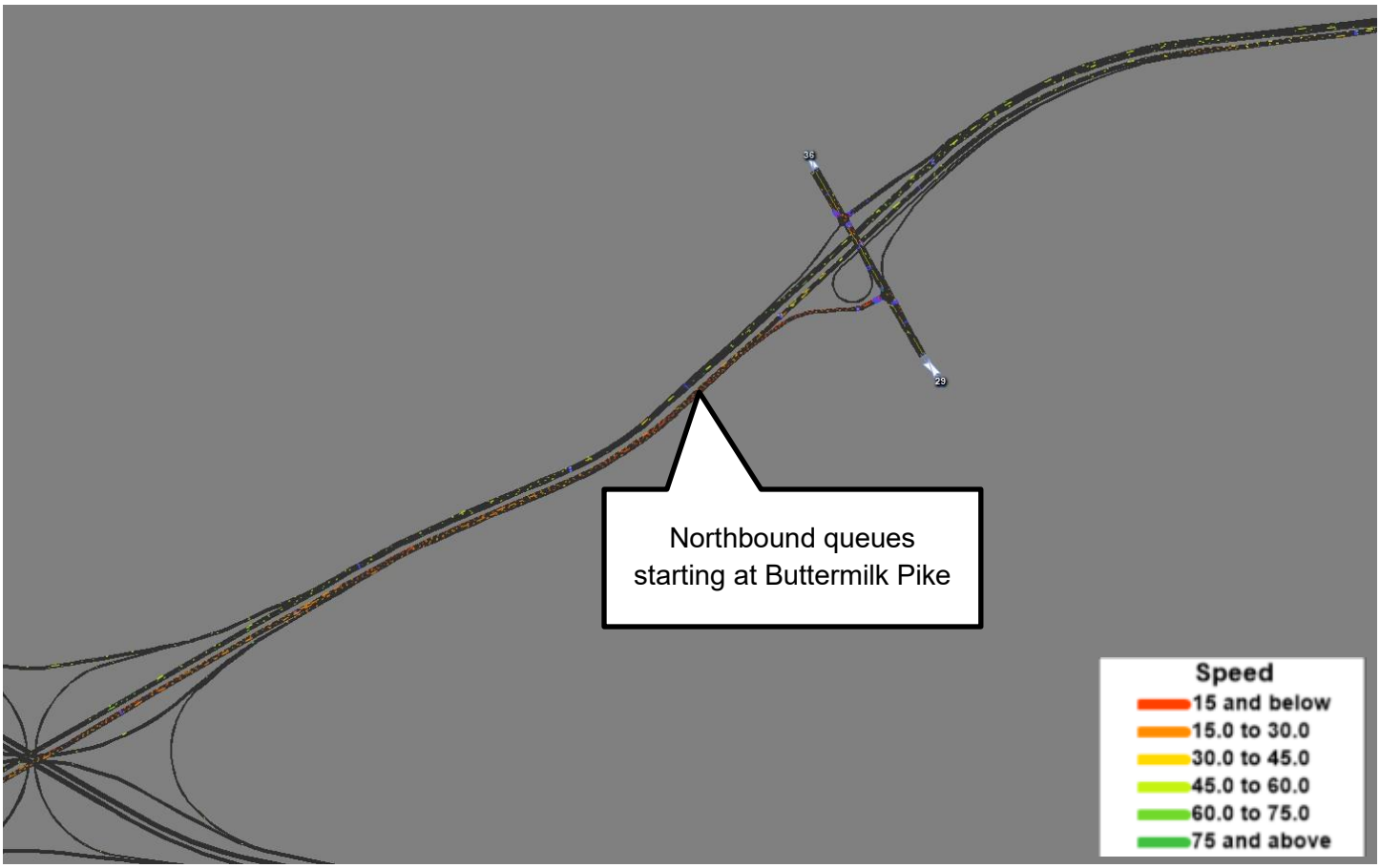
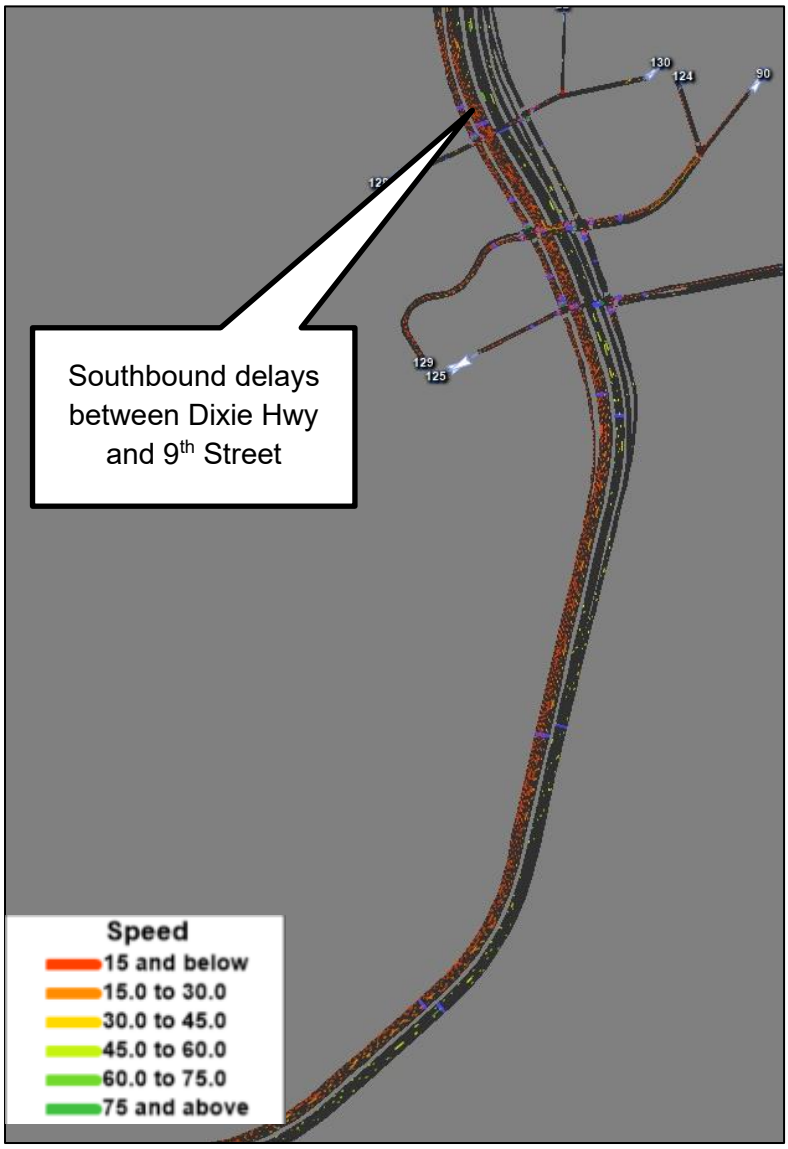


Figure 12: PM 2049 – Sensitivity Analysis



5.1.4 Refined Alternative I (Concept I-W) Summary

Refined Alternative I (Concept I-W) alleviates traffic delays on the I-71/I-75 freeway, which are present in the existing conditions. The ramp terminal intersections have acceptable traffic operations. External constraints still exist for Refined Alternative I (Concept I-W), including traffic delays for US 50, I-71 east of the limits, and I-71/I-75 south of Dixie Hwy (modeling assumes this project is completed). Overall, the TransModeler analysis indicates that Refined Alternative I (Concept I-W) achieves the purpose and need statement of improved traffic operations and passes the evaluation criteria that it does not degrade the operations compared to No Build.

5.2 Build Innovations Operational Results

The Build Innovations design is an enhanced design based on Refined Alternative I (Concept I-W) that incorporates design changes to address stakeholder feedback and is optimized for project costs and constructability. A full description of the innovations is available in the main IMS document. Overall, there are four innovations in Ohio and three innovations in Kentucky. These innovations result in modifications of freeway alignments, ramp and C-D road reconfigurations, and the introduction of additional intersections in Ohio. The proposed innovations preserve freeway travel time close to free-flow conditions and meet LOS standards for intersection and freeway segments, comparable to those achieved under Refined Alternative I (Concept I-W).

5.2.1 AM Peak Period

For the existing condition, inbound Cincinnati traffic is the primary source of traffic delays in the AM Period, with significant traffic delays for NB I-71/75 in Kentucky and SB I-75 north of the BSB. Like Refined Alternative I (Concept I-W), these traffic delays are reduced for Build Innovations with the proposed freeway capacity improvements. TransModeler screen captures of the AM peak hour are shown below in **Figure 13** and **Figure 14**.

In Refined Alternative I (Concept I-W), the US-50 EB traffic experiences travel delays, with insufficient roadway capacity for the one-lane ramp from US-50 EB to I-71. In Build Innovations, the design modifications, including the two-lane ramp from US-50 EB to I-71, eliminate the US-50 queueing and travel delays for this movement.

Another change with Build Innovations is the ramp modifications in downtown Cincinnati. These include removing the direct ramp from SB I-75 to 2nd Street. In Build Innovations, traffic uses the intersections at 3rd Street/ Clay Wade Bridge and Clay Wade Bridge/2nd Street to access 2nd Street. As modeled in TransModeler, these intersections achieve the LOS standards.

Additionally, Build Innovations proposes a CD road connecting 5th, 6th, 7th, and 9th Streets. This change affects how traffic accesses downtown Cincinnati from NB I-75. The modeling indicates that intersections operate with an acceptable level of service with the traffic pattern changes. However, as shown in the model screen capture below, there are minor delays along the NB arterial at 5th Street, 6th Street, and 7th Street.

The innovations in Kentucky include a vertical optimization of I-71/I-75 that results in the closure of 5th Street, Pike Street access modifications that eliminate direct interstate access at 9th Street, and an alignment shift of I-71/75 to avoid a hill cut. These innovations result in minor traffic shifts, but the intersections impacted by the innovations achieve the LOS standards.

Figure 13: Build Innovations AM Peak - Ohio

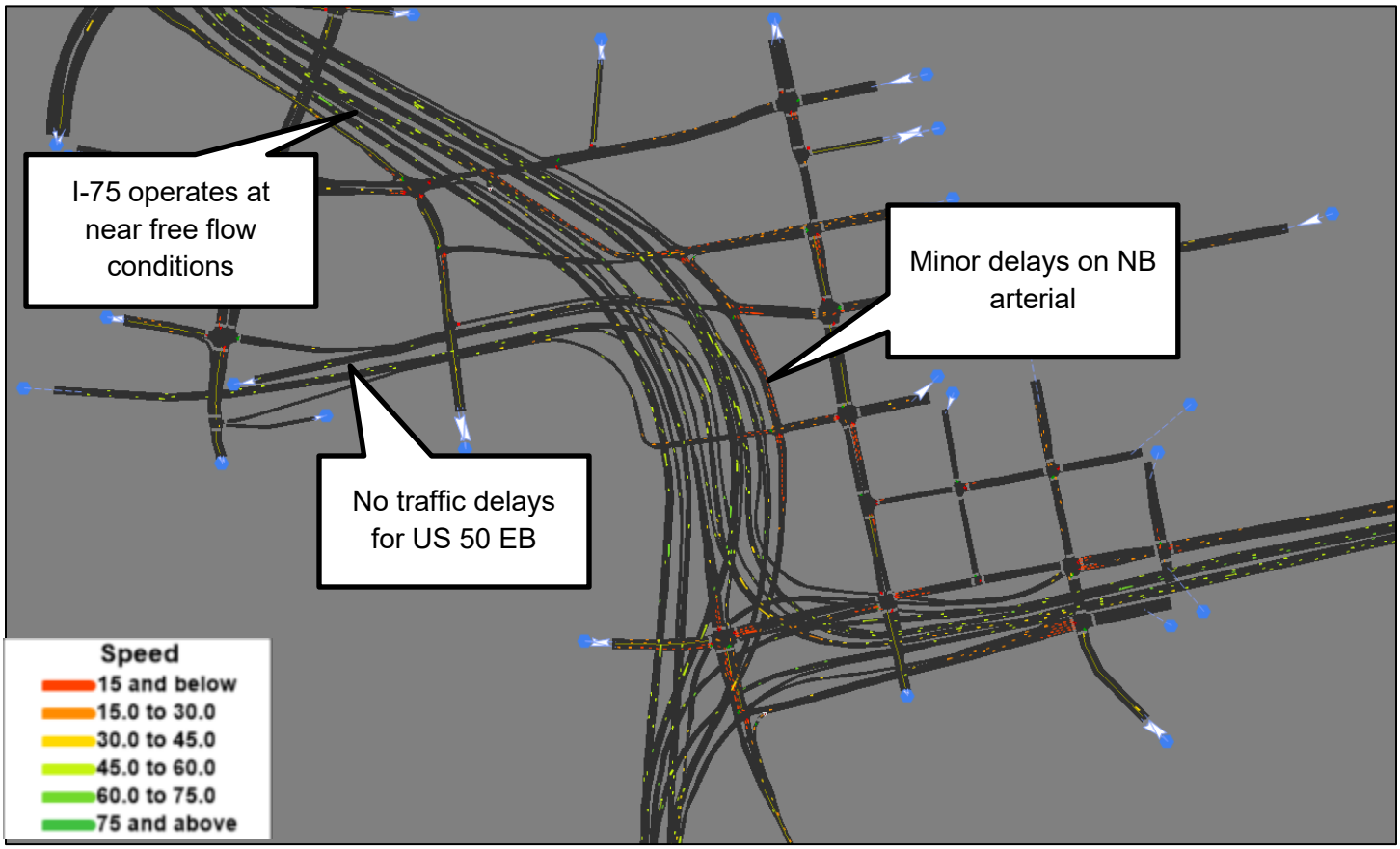
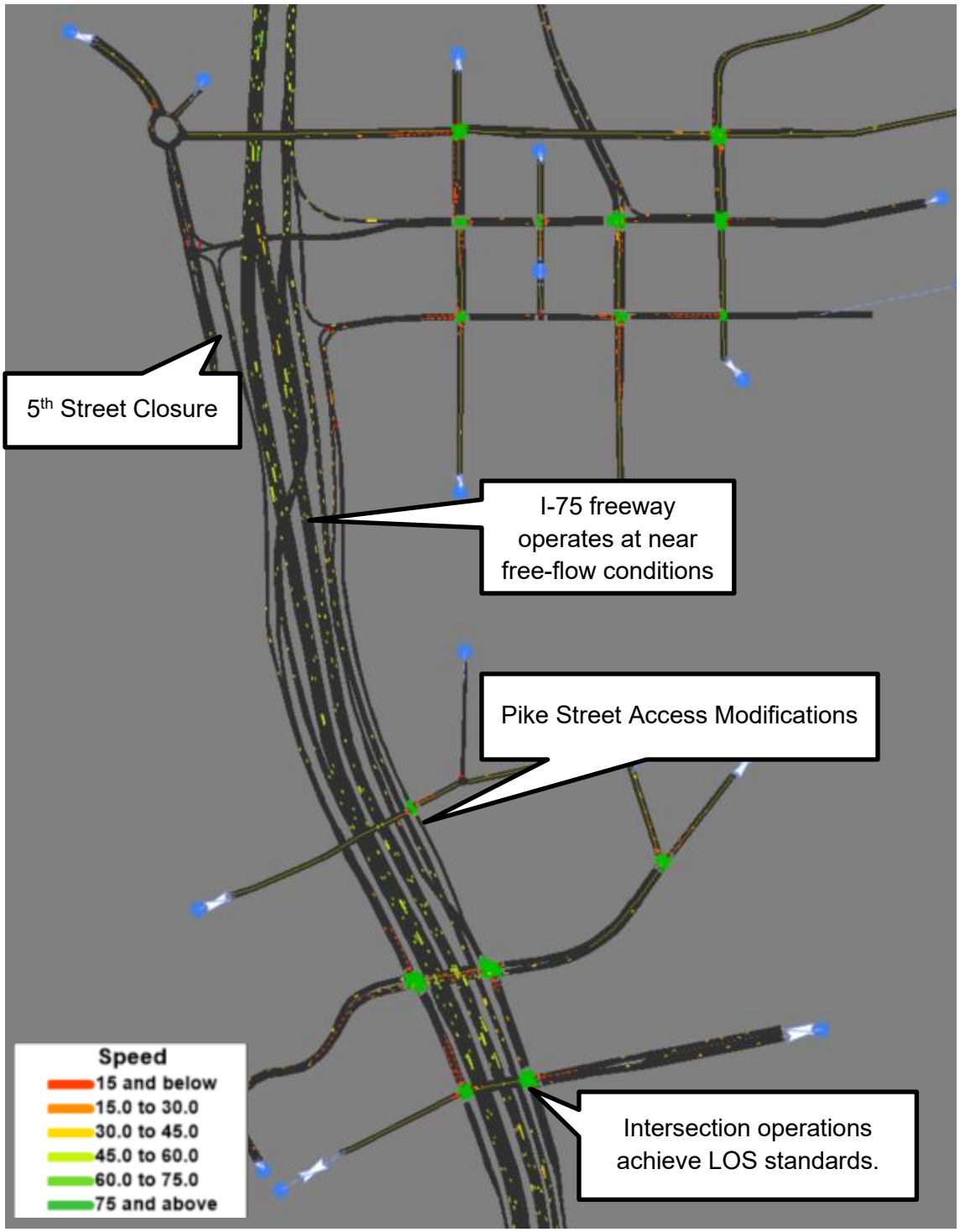


Figure 14: Build Innovations AM Peak – Kentucky



5.2.2 PM Peak Period

Under the existing condition, outbound Cincinnati traffic is the primary source of delays in the PM period, with significant delays for SB I-71/75 in Kentucky and Ohio. The proposed freeway improvements for both build alternatives remove these delays. Overall, the operations for the Build Innovations are acceptable, as indicated by the TransModeler screen captures shown in **Figure 15** and **Figure 16.** One freeway segment with minor traffic delays and a LOS E is NB I-75 at the merge of the mainline and C-D roads, which has a lane drop that aligns with the C-D road lanes on the right side of the road. The traffic forecasts for 2049 have higher traffic demand for the C-D road compared to the through mainline lanes at this location. Restriping the lane drop to be on the left side relieves this traffic delay in the model. However, a left lane drop may impact a higher percentage of truck traffic and be contrary to driver expectations. Due to this factor, the recommendation is to leave the lane drop on the right side and consider pavement restriping after project implementation if the need arises.

Figure 15: Build Innovations PM Peak – Ohio

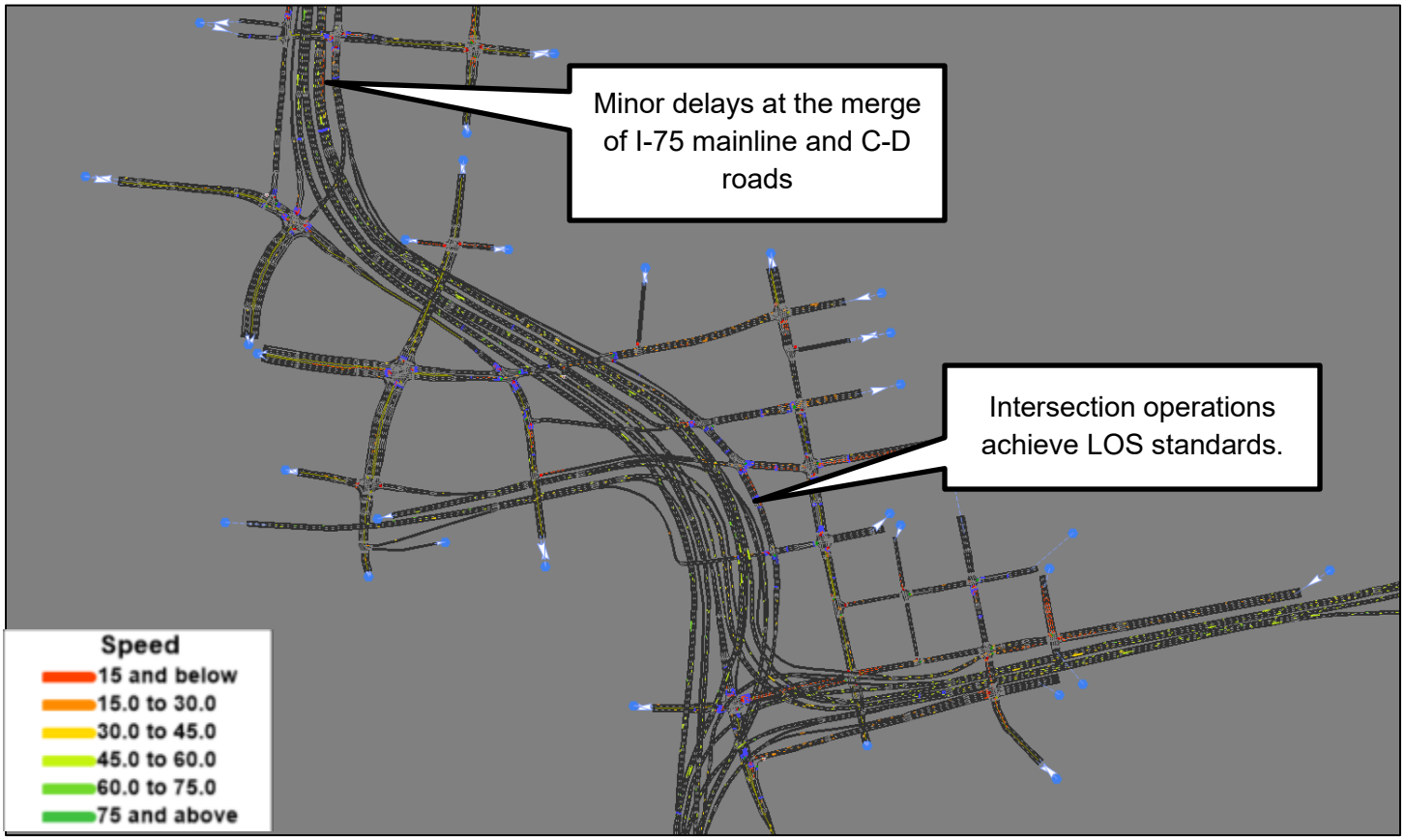
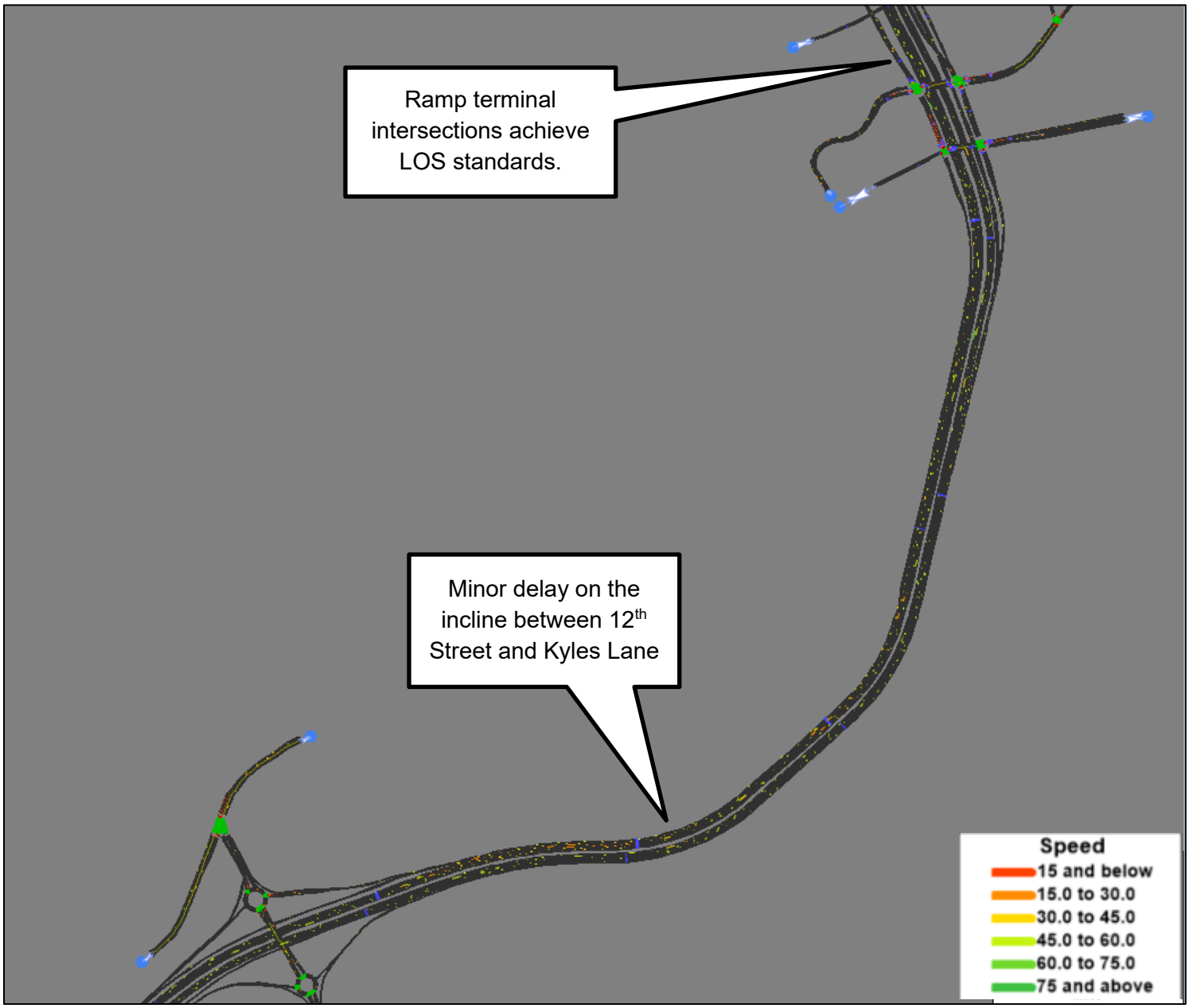


Figure 16: Build Innovations PM Peak – Kentucky



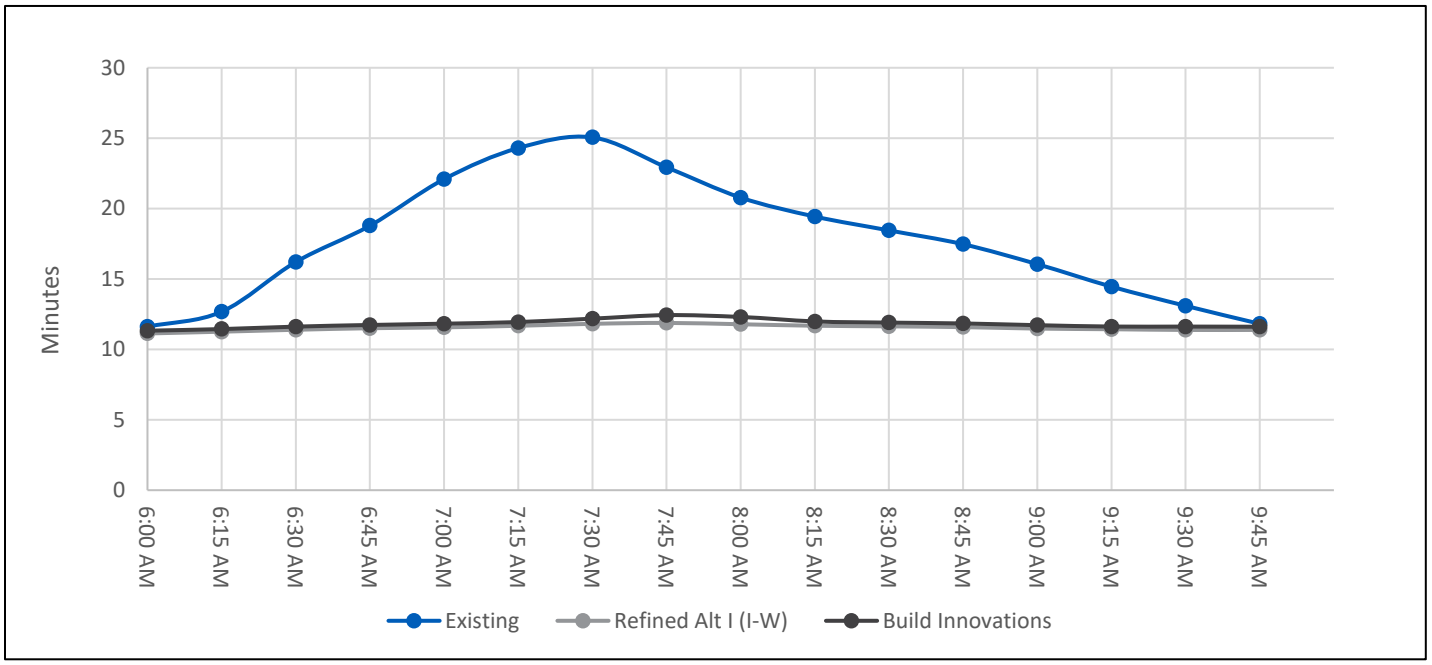
5.3 Alternative Comparison

Section 5.2 presented a visual review of the TransModeler models, demonstrating the operational characteristics of Refined Alternative I (Concept I-W) and Build Innovations. This section summarizes the I-71/I-75 travel time, BSB throughput, intersection LOS, and freeway LOS for the model scenarios and includes a reference to results from the 2019 Existing calibrated model. A null hypothesis test was completed to evaluate the travel time improvements for Build Innovations compared to Refined Alternative I (Concept I-W).

5.3.1 I-71/75 Travel Time

The I-71/I-75 travel times are measured for northbound and southbound directions between the I-275 and I-74 interchanges. This roadway segment is approximately 10.5 miles. In the AM peak period, the NB direction is the peak for existing conditions, which experiences a peak travel time of 25 minutes. Both Build Innovations and Refined Alternative I (Concept I-W) have free-flow travel times of about 12 minutes throughout the peak period.

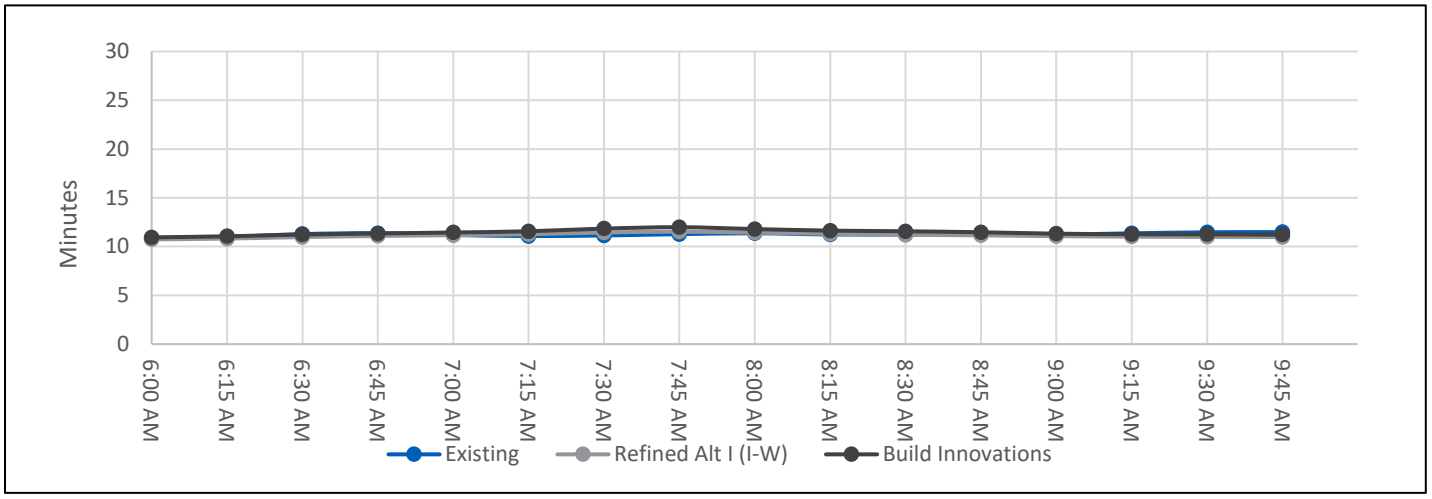
Figure 17: NB I-71/I-75 Travel Time – AM Period



Note: travel time for Build Innovations overlaps Refined Alternative I (Concept I-W) on the graph

SB I-71/75 is the off-peak direction during the AM peak hour. The existing model shows free-flow travel times in 2019 and maintains the free-flow condition for Build Innovations and Refined Alternative I (Concept I-W).

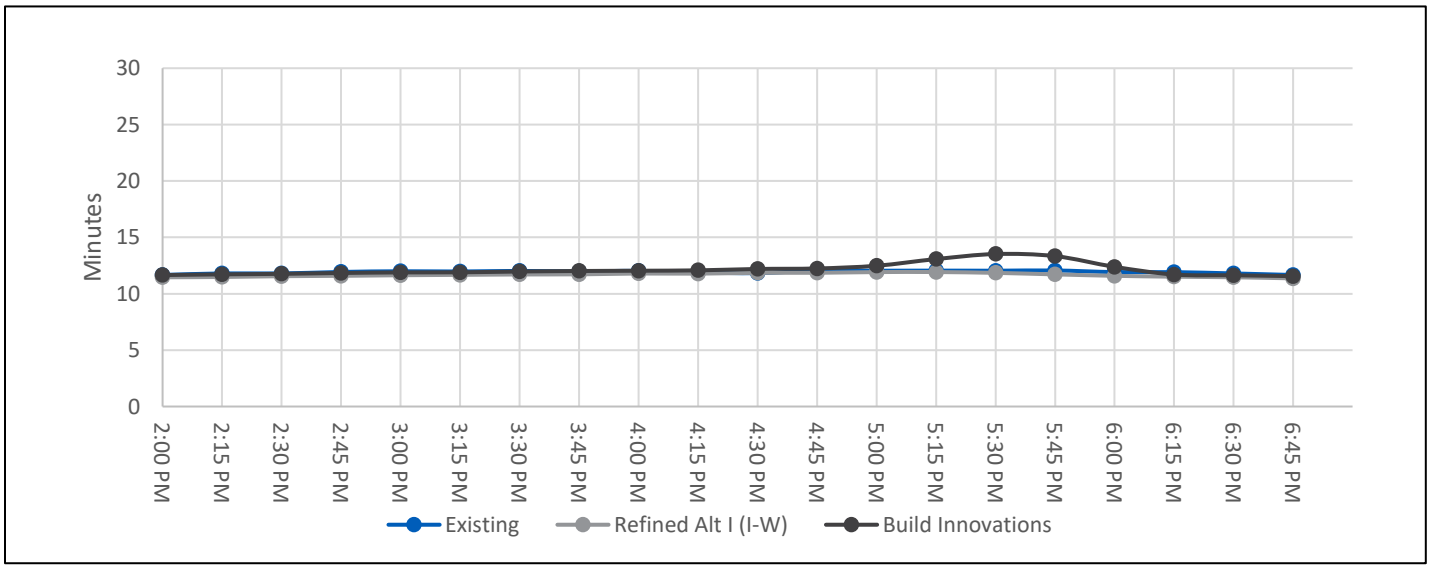
Figure 18: SB I-71/I-75 Travel Time – AM Period



Note: travel time for Build Innovations overlaps Refined Alternative I (Concept I-W) and Existing on the graph

In the PM peak, NB I-71/75 is the off-peak direction with free flow travel times for Existing 2019, which are mostly maintained for 2049 Build Innovations and Refined Alternative I (Concept I-W). The Build Innovations alternative results in a slight increase in travel time during the PM peak hour, primarily due to slower traffic at the NB I-75 mainline and C-D road merge, along with additional delays occurring just north of the project limits near Hopple Street. The delays in the north are related to the additional volume throughput achieved with the Build Innovations design. The overall demand for Refined Alternative I (Concept I-W) and Build Innovations is similar; however, the throughput is higher for Build Innovations due to project improvements that alleviate existing traffic bottlenecks present in the Refined Alternative I (Concept I-W) design.

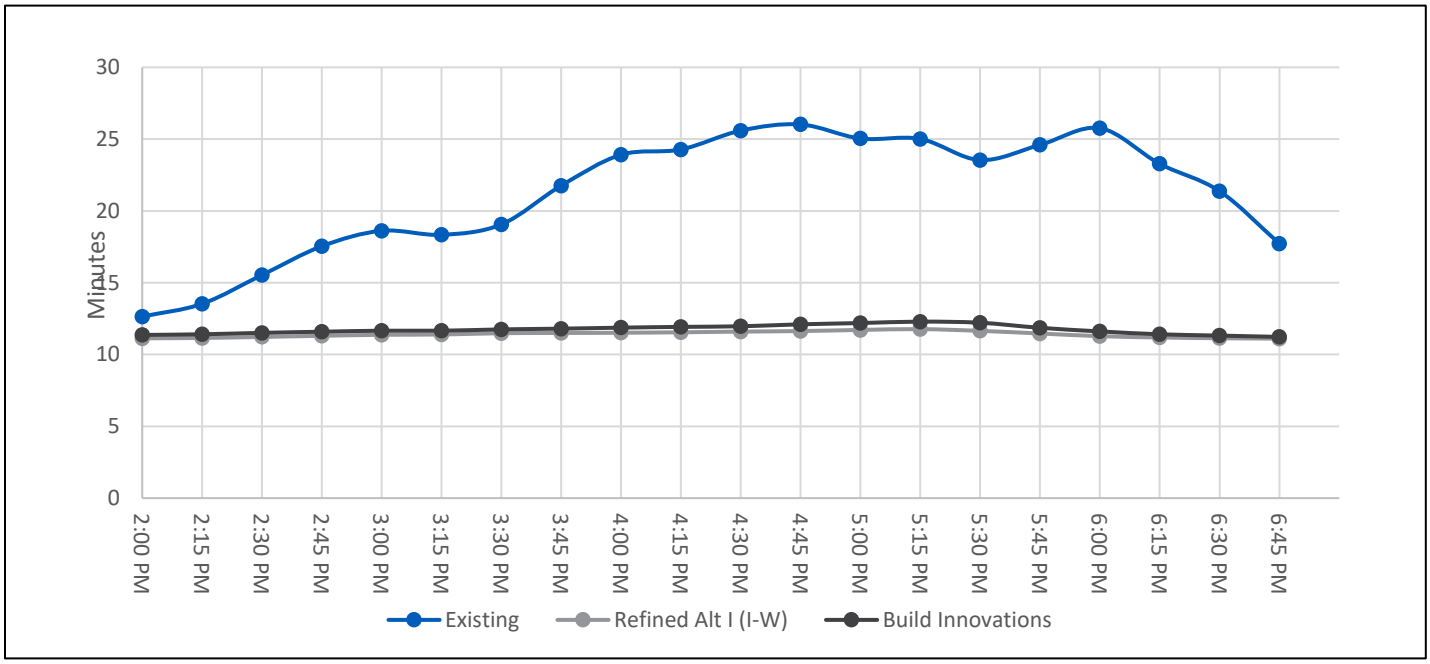
Figure 19: NB I-71/I-75 Travel Time – PM Period



Note: travel time for Build Innovations overlaps Refined Alternative I (Concept I-W) and Existing on the graph

SB I-71/I-75 is the peak direction for the PM peak period. The existing 2019 model shows travel times are greater than 20 minutes for multiple hours in the period. Build Innovations and Refined Alternative I (Concept I-W) maintain free flow conditions for the peak period.

Figure 20: SB I-71/I-75 Travel Time – PM Period



5.3.2 Brent Spence Bridge and Companion Bridge Throughput

The BSB is an I-71/I-75 corridor traffic bottleneck for the existing condition. A comparison of the traffic throughput (BSB and Companion Bridge) for 2019 Existing, Refined Alternative I (Concept I-W), and Build Innovations is summarized in the following figures. As is shown in these figures, the BSB throughput for Build Innovations and Refined Alternative I (Concept I-W) are very similar, with no observed capacity constraint. Some of the minor differences in volume are related to access differences that affect the BSB traffic forecasts. Additionally, Refined Alternative I (Concept I-W) has some external capacity constraints for EB US-50 and SB I-71, which are resolved in the design of Build Innovations and lead to increased traffic throughput. In contrast, the existing condition experiences capacity constraints in the peak directions due to severe queuing. It only serves part of the BSB traffic demand for AM and PM peak travel directions.

Figure 21: Northbound BSB Traffic Throughput – AM Period

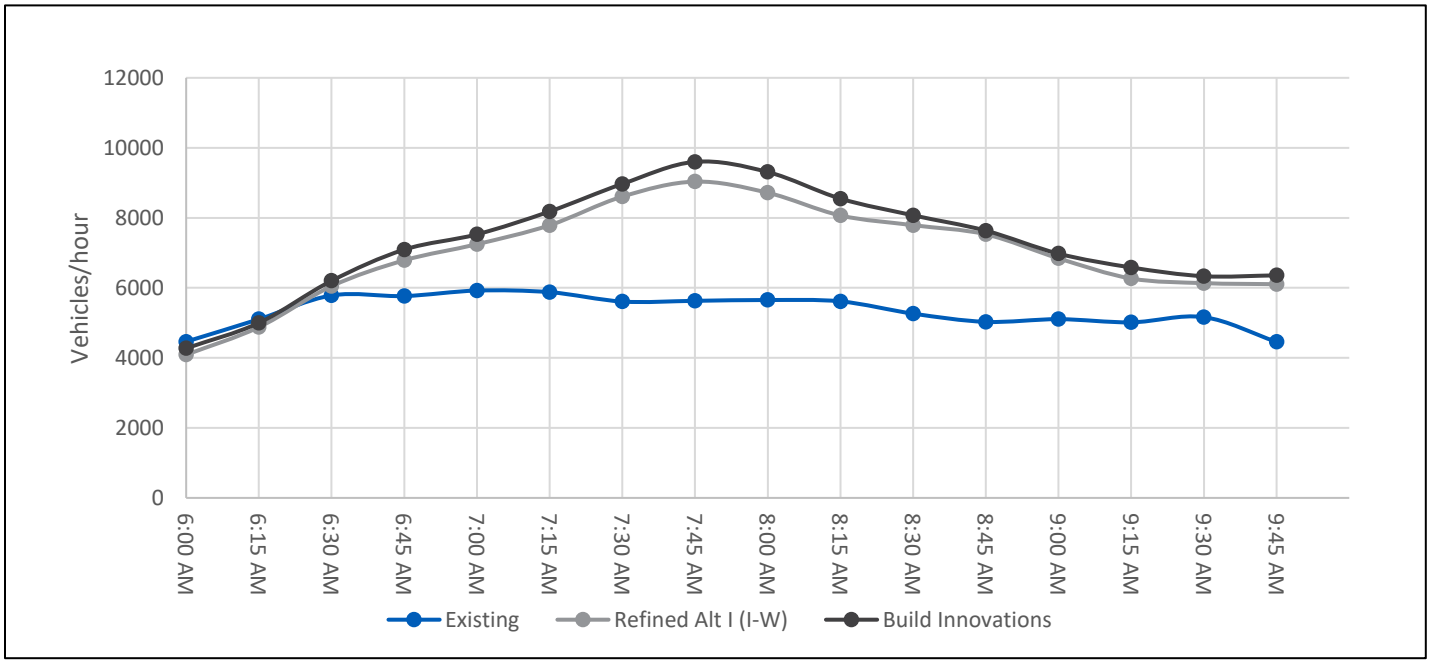


Figure 22: Southbound BSB Traffic Throughput – AM Period

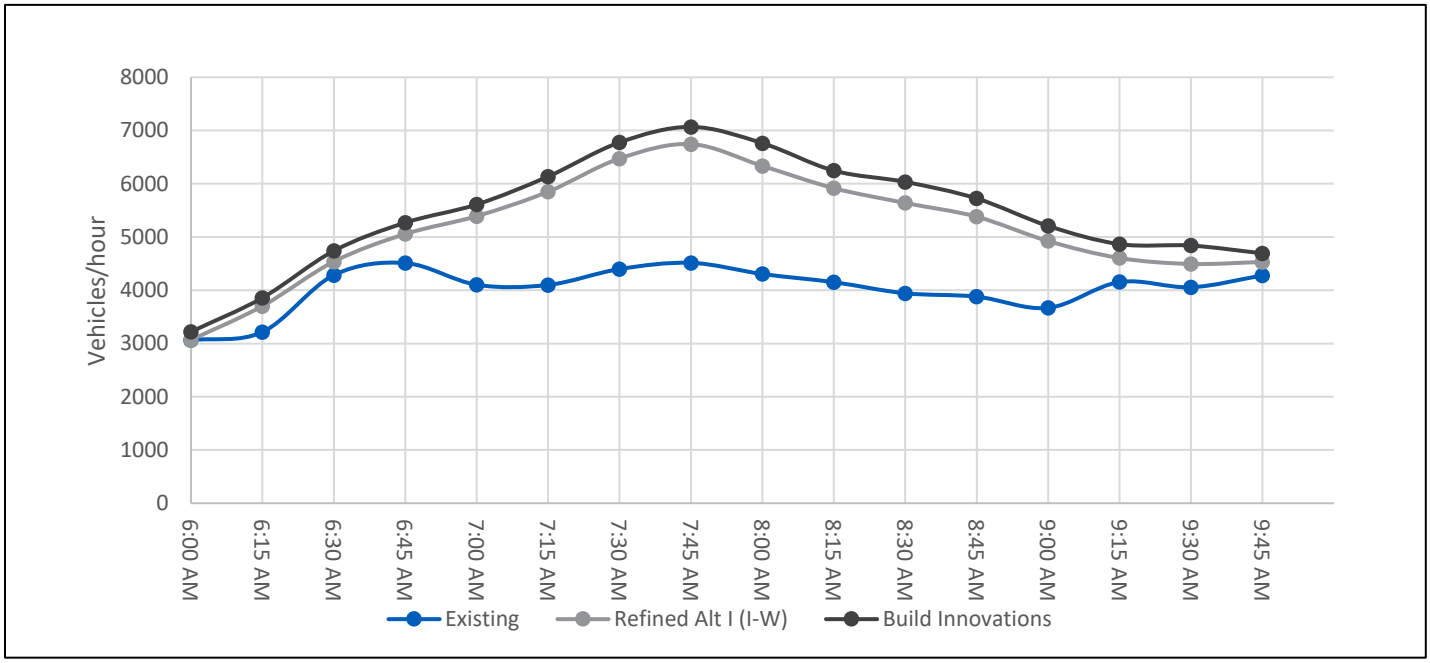


Figure 23: Northbound BSB Traffic Throughput – PM Period

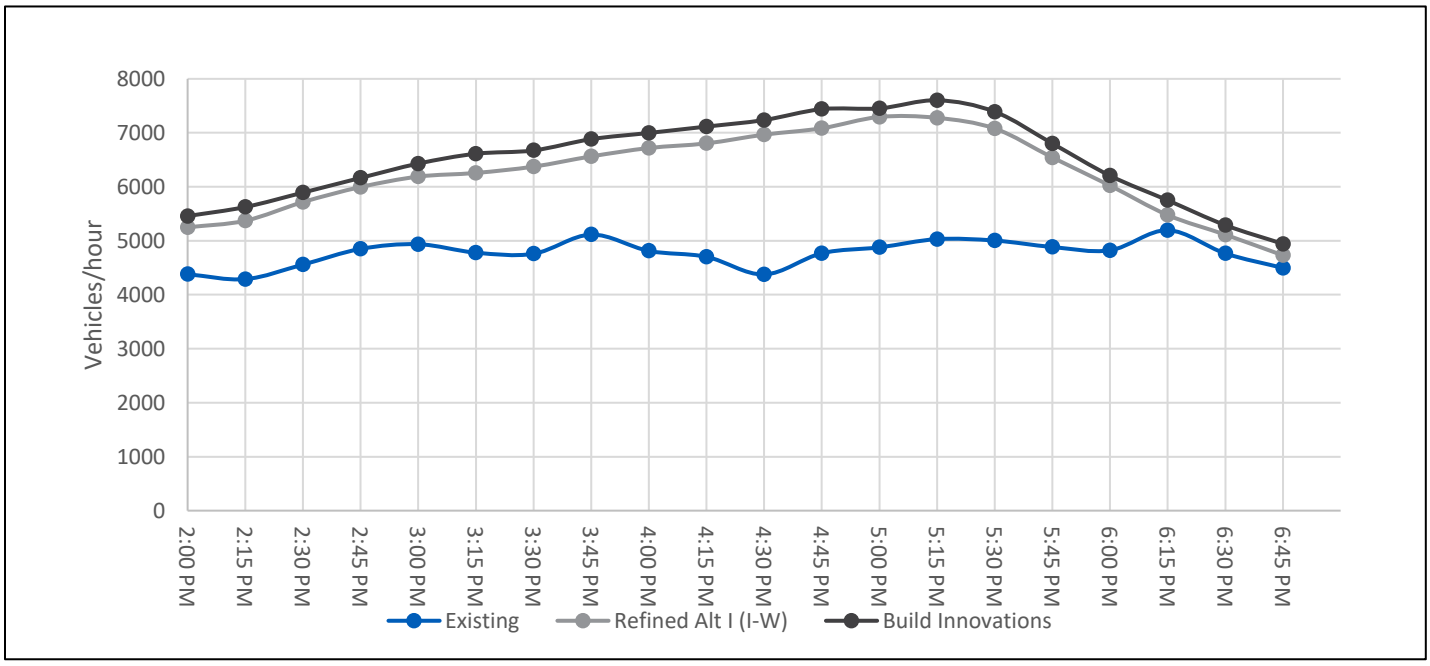
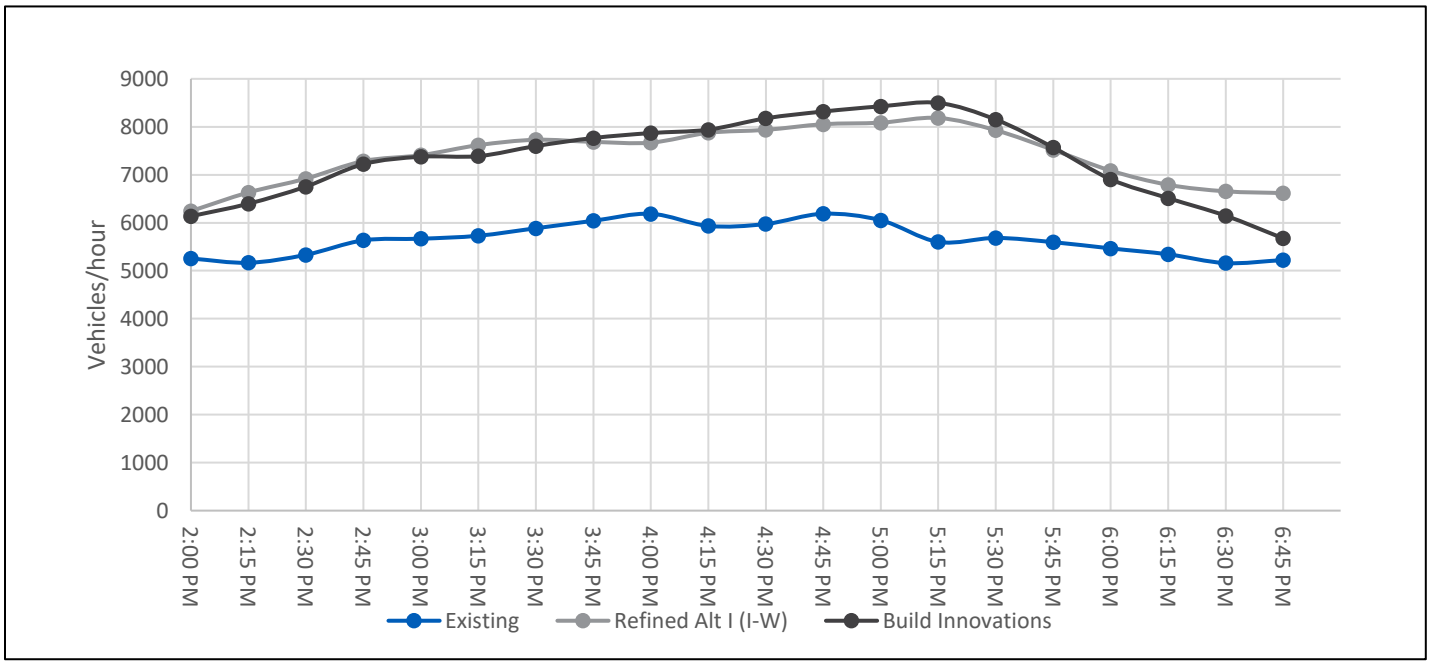


Figure 24: Southbound BSB Traffic Throughput – PM Period



5.3.3 Hypothesis Testing for I-71/I-75 Travel Time

Section 4.4 describes the hypothesis testing and compares the critical measures of interest for the design alternatives. These critical measures are travel time in the northbound direction for the AM peak and travel time in the southbound direction for the PM peak. The results comparing Build Innovations to Refined Alternative I (Concept I-W) are presented in **Table 4** (AM) and **Table 5** (PM). The previous IMS addendum compared the No Build to Refined Alternative I (Concept I-W) and demonstrated the benefit of the build alternative. A hypothesis test comparing the No Build and Build Innovations is not included in this IMS addendum, as the focus of the addendum is to compare Build Innovations to Refined alternative I (Concept I-W).

Table 4: Alternative Analysis for Travel Time NB in AM Peak (Build Innovations – Refined Alt I (I-W))

Variable	Build Innovations	Refined Alternative I (Concept I-W)
Number of Runs	10	10
Travel Time Mean	11.8250	11.5357
Travel Time Variance	0.0003	0.0001
Pooled Variance	0.0001	
$t_{(n1 + n2 - 2),\ 95\%}$	2.1009	
$t_{calculated}$	45.2660	
Hypothesis	$H_0: \mu_1 \leq \mu_2$, $H_A: \mu_1 > \mu_2$	
Conclusion	We reject H0	

Table 5: Alternative Analysis for Travel Time SB in PM Peak (Build Innovations – Refined Alt I (I-W))

Variable	Build Innovations	Refined Alternative I (Concept I-W)
Number of Runs	10	10
Travel Time Mean	11.8027	11.4087
Travel Time Variance	0.0021	0.0004
Pooled Variance	0.0003	
$t_{(n1 + n2 - 2),\ 95\%}$	2.1009	
$t_{calculated}$	25.285	
Hypothesis	$H_0: \mu_1 \leq \mu_2$, $H_A: \mu_1 > \mu_2$	
Conclusion	We reject H0	

The conclusion of the hypothesis test for the AM and PM model shows that we reject the null hypothesis that the travel time for Build Innovations is lower than or equal to the travel time for Refined Alternative I (Concept I-W). Therefore, the travel time for Build Innovations is higher than Refined Alternative I (Concept I-W) for the AM and PM peak directions. However, the difference in travel times for the corridor is less than 30 seconds, which is attributable to minor differences in model structure between the alternatives and also associated with

the higher volume throughput that is achieved for the Build Innovation design that removes the external bottlenecks at I-71 SB and US-50 EB.

5.3.4 Freeway Level of Service

TransModeler was used to measure the freeway level of service for the I-71, I-75, US 50, and C-D roads. The project study area was divided into HCM-defined segments, including diverges, merges, weaves, and basic segments. TransModeler creates model output densities for these segments in pc/mi/ln units. LOS for each segment was assigned using the HCM density-LOS scale. Although these are simulation-based LOS, this method provides a consistent point of comparison for multiple alternatives. These segments and the resultant LOS for each scenario are summarized in the appendices. A high-level summary of the segments that fall within each LOS grade is outlined in **Table 6**. The same project limits are analyzed for all alternatives, but a different number of HCM segments was defined for each alternative.

Table 6: Freeway Segments by LOS Grade

Peak Period	LOS	2049 Refined Alternative I (Concept I-W)	2049 Build Innovations
AM	C or better	62	50
	D	27	31
	E	1	6
	F	1	0
PM	C or better	57	50
	D	25	24
	E	6	11
	F	3	2

Build Innovations and Refined Alternative I (Concept I-W) have only a few segments in the LOS F and LOS E categories. For Build Innovations, there are two LOS F segments in the PM that occur on SB I-75 between 12th Street and Kyles Lane, and NB I-75 at the merge of the WHV entrance ramp. The SB I-75 segment is on a steep incline, and speed reductions were observed in both alternatives. The NB I-75 segment has the same design in both alternatives and is outside the design limits of Build Innovations.

5.3.5 Intersection Level of Service

The operations analysis for the IMS addendum includes 68 intersections. The operational goal is to have the intersections operate at LOS D or better. The results for each intersection are summarized in **Table 7** (Kentucky) and **Table 8** (Ohio). As shown in the tables, Build Innovations achieves the intersection LOS target for all intersections. Refined Alternative I (Concept I-W) has one intersection with LOS F and three intersections with LOS E, including Philadelphia and 9th Street, Bullock and Pike Street, and Bullock and 12th Street.

Table 7: Intersection Level of Service - Kentucky

Intersection	Refined Alt I (I-W)	Build Innovations	Refined Alt I (I-W)	Build Innovations
	AM Period		PM Period	
NB I-71/I-75 & Dixie Hwy	C	A	A	A
NB I-71/I-75 & Kyles Lane	C	A	B	A
SB I-71/I-75 & Dixie Hwy	C	D	C	A
SB I-71/I-75 & Kyles Lane	B	B	C	B
Dixie Hwy & Kyles Lane	C	B	C	B
Main St & Pike St	C	C	B	B
5th St & Main St	C	C	B	C
4th St & Main St	B	B	B	B
Simon Kenton & 12th St	C	B	C	C
Philadelphia St & 9th St	F	A	A	A
Simon Kenton & Pike	D	B	C	D
Simon Kenton & 9th St	D	C	B	C
Philadelphia & 5th St	D	C	C	C
Philadelphia & 4th St	C	D	C	C
Bullock & 12th St	D	C	E	C
Bullock & Pike St	E	C	B	D
Bullock & 9th St	A	N/A	A	N/A
Crescent & 5th St	A	N/A	A	N/A
Crescent & 4th St	A	A	A	A
Johnson St & 5th St*	-	C	-	B
Johnson St & 4th St*	-	B	-	B
Johnson St & 3rd St*	-	B	-	C
Philadelphia St & 3rd St*	-	C	-	C
Crescent & 3rd St*	-	B	-	A

*Intersections analyzed only for Build Innovations

Table 8: Intersection Level of Service – Ohio

Intersection	Refined Alt I (I-W)	Build Innovations	Refined Alt I (I-W)	Build Innovations
	AM Period		PM Period	
Central Ave & 3rd St	D	D	D	D
Central Ave & 4th St	B	A	B	B
Central Ave & 5th St	C	C	B	C
Central Ave & 6th St	A	B	C	D
Central Ave & 7th St	B	B	B	B
Central Ave & 9th St	B	B	C	B
Mound St & 9th St	A	A	A	A
US-42 & 3rd St	C	D	C	D
Gest St & 6th St	A	A	A	A
NB I-75 & 5th Street	B	C	B	B
NB Arterial & 6th Street	N/A	D	N/A	B
NB Arterial & 7th St	N/A	D	N/A	A
NB Arterial & 9th St	N/A	A	N/A	A
Gest St & 8th St	N/A	C	N/A	C
Elm St & 2nd St	B	B	B	C
Race St & 3rd St	B	B	C	C
Elm St & 3rd St	B	B	B	B
Elm St & 4th St	B	B	B	B
Plum St & 3rd St	A	A	B	A
Plum St & 4th St	A	B	A	B
Linn St & 6th St	B	B	B	B
Linn St & 8th St	B	C	B	C
Linn St & Court St	A	A	A	C
Linn St & Ezzard Charles Dr	C	C	C	C
Winchell Ave & Ezzard Charles	B	B	B	B
Freeman Ave & Gest St	C	B	B	B
Western Ave & Gest St	A	B	A	B
Western Ave & Ezzard Charles	A	A	A	A
Winchell Ave & Liberty St	A	A	B	A
Winchell Ave & Findlay St	B	C	B	C
Western Ave & Liberty St	B	B	B	B
Western Ave & Findlay St	B	B	B	B
Dalton Ave & Findlay St	B	B	C	C
Linn St & Bank St	A	A	A	A
Linn St & Central Pkwy	C	B	C	B
Brighton Pl & Central Ave	A	A	A	A
Brighton Pl & Central Pkwy	D	C	C	C
McMillian Ave & Central Pkwy	D	C	C	C
Colerain Ave & Harrison St	A	A	A	A
Patterson St & Harrison St	A	A	A	A
Winchell Ave & Bank St	C	C	C	D
Winchell Ave & Harrison St	A	A	A	A
NB I-75 & WHV	B	B	B	B
Spring Grove Ave & Bank St	A	A	A	B

Intersection	Refined Alt I (I-W)	Build Innovations	Refined Alt I (I-W)	Build Innovations
	AM Period		PM Period	
Spring Grove Ave & Harrison	B	B	B	B
SB I-75 & WHV	B	A	B	B
WHV Ramp & Harrison Street	A	A	A	A

To demonstrate the operational acceptability of the Build Innovations design, intersection-level performance details are provided in **Table 9** and **Table 10**, which shows LOS by approach. The OATS manual specifies LOS E or better as the operational target for intersection approaches, and most intersections meet this target with a few exceptions:

- EB and WB approaches at Linn Street and Court Street
- SB I-71/I-75 approach at the Dixie Hwy roundabout during the AM peak
- EB approach at US 42 and 3rd Street during the AM peak

The Linn and Court Street intersection remains two-way stop-controlled with minimal cross-street volumes, so the reported LOS F is not operationally significant. For the Dixie Hwy roundabout, the SB approach shows LOS F in TransModeler during the AM peak, despite carrying only minor amount of vehicles. This result reflects a modeling limitation rather than a design deficiency, as TransModeler applies default parameters for roundabouts due to the absence of existing roundabouts in the study area. To validate the operations, the same intersection was analyzed using Highway Capacity Software (HCS), which yielded LOS C, well within acceptable limits.

The project team is proceeding with the roundabout design because HCS results confirm acceptable operations and because roundabouts provide safety and efficiency benefits consistent with project goals. The EB approach at 3rd Street exhibits LOS F due to heavy right-turn volumes; however, these movements utilize a dedicated lane and do not impact upstream intersections.

Table 9: Kentucky Intersection Approach LOS – Build Innovations

Intersection	AM Period				PM Period			
	WB	EB	NB	SB	WB	EB	NB	SB
NB I-71/I-75 & Dixie Hwy	B	A	A	-	A	A	E	-
NB I-71/I-75 & Kyles Lane	A	A	B	-	A	A	C	-
SB I-71/I-75 & Dixie Hwy	A	A	-	F	C	A	-	C
SB I-71/I-75 & Kyles Lane	A	A	-	A	A	A	-	D
Dixie Hwy & Kyles Lane	B	C	A	-	B	C	A	-
Main St & Pike St	C	C	-	A	C	B	-	A
5th St & Main St	-	C	D	E	-	C	C	C
4th St & Main St	A	-	C	B	A	-	B	C
Simon Kenton & 12th St	C	A	B	-	C	B	B	-
Philadelphia St & 9th St	A	A	-	A	A	A	-	A
Simon Kenton & Pike St	C	A	C	-	C	D	C	-
Simon Kenton & 9th St	C	D	A	-	C	D	A	-
Philadelphia & 5th St	-	B	D	D	-	B	D	D

Intersection	AM Period				PM Period			
	WB	EB	NB	SB	WB	EB	NB	SB
Philadelphia & 4th St	C	-	D	D	B	-	C	C
Bullock & 12th St	B	B	-	D	B	C	-	D
Bullock & Pike St	C	C	-	C	B	D	-	D
Crescent & 4th St	A	-	A	A	A	-	A	A
Johnson St & 5th St	-	C	B	B	-	C	A	A
Johnson St & 4th St	B	-	D	B	B	-	C	B
Johnson St & 3rd St	B	B	B	C	C	C	B	B
Philadelphia St & 3rd St	B	C	C	B	C	C	B	B
Crescent & 3rd St	C	A	C	A	B	A	A	A

Table 10: Ohio Intersection Approach LOS – Build Innovations

Intersection	AM Period				PM Period			
	WB	EB	NB	SB	WB	EB	NB	SB
Central Ave & 3rd St	D	C	C	D	C	D	D	D
Central Ave & 4th St	A	-	A	A	A	-	B	A
Central Ave & 5th St	-	B	C	C	-	B	C	B
Central Ave & 6th St	B	-	A	B	B	-	B	D
Central Ave & 7th St	-	A	D	-	-	B	A	-
Central Ave & 9th St	B	-	B	A	C	-	C	A
Mound St & 9th St	A	-	-	B	A	-	-	C
US-42 & 3rd St	D	F	C	C	E	C	D	D
Gest St & 6th St	C	-	A	A	B	-	A	A
NB I-75 & 5th Street	-	C	C	-	-	C	A	-
NB Arterial & 6th Street	E	-	D	-	A	-	D	-
NB Arterial & 7th St	-	D	D	-	-	A	A	-
NB Arterial & 9th St	A	-	A	-	A	-	B	-
Gest St & 8th St	B	C	D	A	C	C	C	A
Elm St & 2nd St	-	A	C	-	-	B	E	-
Race St & 3rd St	B	-	-	B	C	-	-	D
Elm St & 3rd St	B	-	B	-	A	-	D	-
Elm St & 4th St	A	-	B	-	B	-	B	-
Plum St & 3rd St	A	-	-	A	A	-	-	A
Plum St & 4th St	B	-	-	A	B	-	-	B
Linn St & 6th St	C	A	C	C	C	A	C	C
Linn St & 8th St	A	B	D	C	A	D	D	B
Linn St & Court St	B	B	A	A	F	F	A	A
Linn St & Ezzard Charles Dr	C	C	B	C	C	C	C	C
Winchell Ave & Ezzard Charles	B	B	B	-	B	B	C	-
Freeman Ave & Gest St	B	B	C	B	C	B	C	B
Western Ave & Gest St	A	A	-	B	B	A	-	B
Western Ave & Ezzard Charles	B	A	-	A	B	A	-	A
Winchell Ave & Liberty St	A	A	A	-	A	A	A	-
Winchell Ave & Findlay St	A	C	C	-	A	C	C	-
Western Ave & Liberty St	C	B	-	A	B	B	-	B
Western Ave & Findlay St	A	A	-	A	B	A	-	A
Dalton Ave & Findlay St	B	C	C	B	C	C	C	C
Linn St & Bank St	-	A	A	A	-	B	A	A
Linn St & Central Pkwy	B	B	B	B	B	A	C	B

Intersection	AM Period				PM Period			
	WB	EB	NB	SB	WB	EB	NB	SB
Brighton Pl & Central Ave	A	A	-	A	A	A	-	A
Brighton Pl & Central Pkwy	A	D	A	-	A	D	B	-
McMillian Ave & Central Pkwy	C	B	B	C	C	B	B	C
Colerain Ave & Harrison St	A	A	-	A	A	A	-	A
Patterson St & Harrison St	A	A	A	-	A	A	A	-
Winchell Ave & Bank St	C	D	D	-	B	D	D	-
Winchell Ave & Harrison St	A	A	A	-	A	A	A	-
NB I-75 & WHV	-	B	B	-	-	C	A	-
Spring Grove Ave & Bank St	A	B	A	A	A	B	C	B
Spring Grove Ave & Harrison	B	A	A	B	B	A	B	B
SB I-75 & WHV	A	-	-	A	A	-	-	C
WHV Ramp & Harrison Street	A	A	-	A	A	A	-	A

6. CONCLUSION

The purpose of this BSB IMS addendum traffic operations analysis is to show that Build Innovations has acceptable traffic operations for the I-71 & I-75 freeway and adjacent ramp terminal intersections as compared to Refined Alternative I (Concept I-W). This conclusion can be made based on the TransModeler analysis. The Brent Spence Bridge capacity constraint is removed for both Build Innovations and Refined Alternative I (Concept I-W), which leads to free-flow traffic conditions on the freeway mainline throughout the project area, a significant operational improvement compared to the existing condition. Additionally, the design modifications for Build Innovations do not adversely impact the operations of the C-D roadway, ramp terminal intersections, and adjacent arterial streets, as measured by the TransModeler analysis. Overall, Build Innovations achieves the operational goals of the project's purpose and need.

Appendix A:
BSB TransModeler Calibration Report

BRENT SPENCE BRIDGE CORRIDOR PROJECT

TRANSMODELER CALIBRATION

IMS ADDENDUM

NOVEMBER 7, 2025

TEAM KENTUCKY TRANSPORTATION CABINET

HNTB

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Revision Record

Rev #	Date	Description	ODOT Approval	KYTC Approval	FHWA Approval
0	4/19/2023	Original submittal approved by ODOT, KYTC, and FHWA			
1.1	8/22/2025	Text revisions to address FHWA comments from the July 2025 IMS Addendum review. The TransModeler calibration does not change with these updates. Key changes include: • Clarified clustering methodology • Added Figures 11 and 12 to Volume Development section • Defined critical periods for calibrations			
1.2	11/7/2025	Text revisions to address an FHWA comment from the November 2025 IMS Addendum review. • Page 3, bullet point 1a has been updated to expand the discussion on how roadway grades and the operational characteristics of these grades were considered during the model calibration. • Figures 15, 17, 20, and 22 have been updated to show critical time intervals. • Tables 3, 4, 5, and 6 have been updated to show the criterion 2 is achieved for the critical time intervals. • Section 6 updated to identify that the segments with steep grade are covered by the local headway buffer calibration.			

1. INTRODUCTION

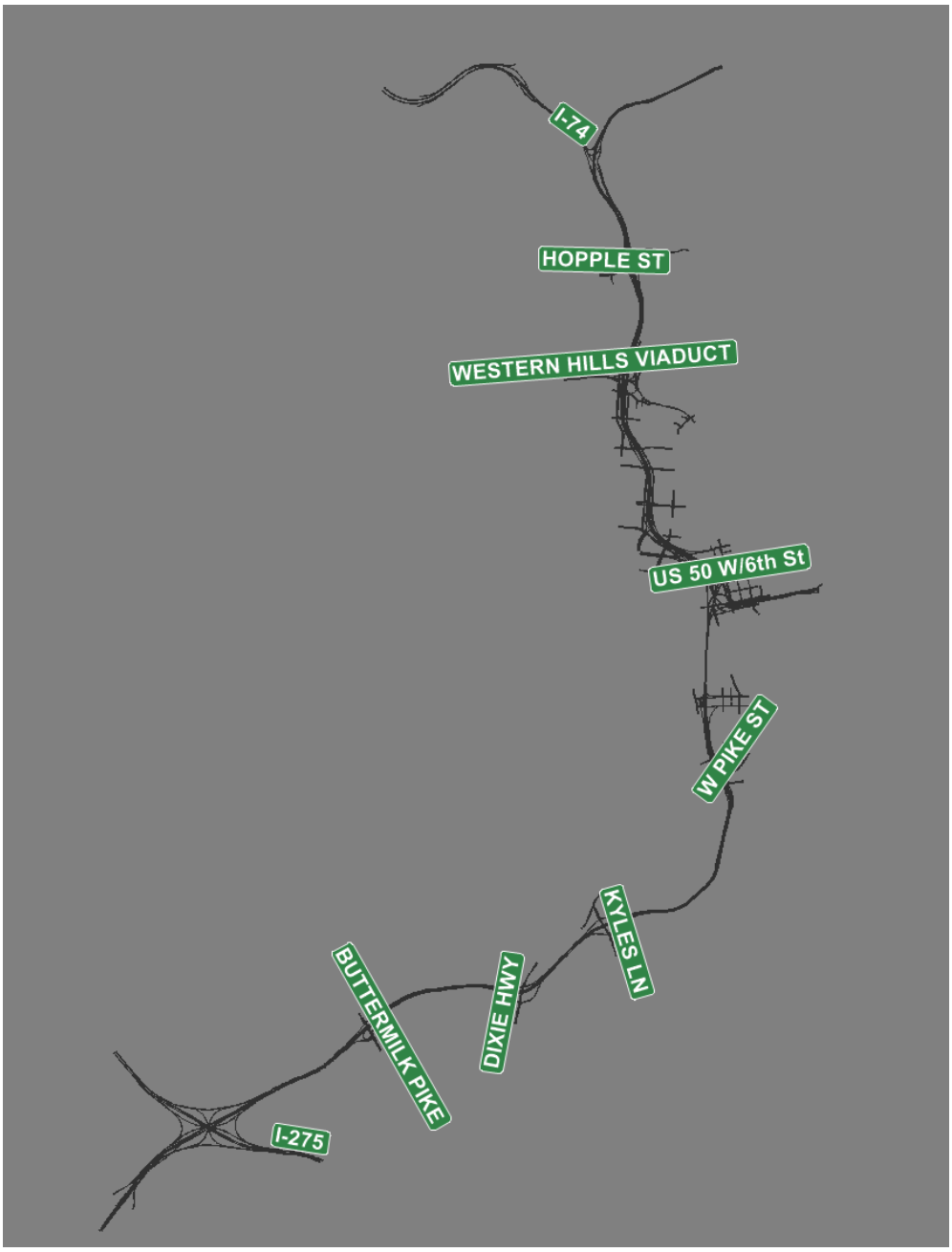
The Brent Spence Bridge Corridor consists of 7.8 miles of I-71 and I-75 in portions of Ohio and Kentucky. It is located within the Greater Cincinnati/Northern Kentucky region and is a major route for local and regional mobility. Locally, it connects to I-74, I-275, and US 50. The Brent Spence Bridge provides an interstate connection over the Ohio River and carries both I-71 and I-75 traffic. This Corridor is also one of the busiest trucking routes in the US, connecting Michigan to Florida via I-75.

Since 2013, there have been multiple traffic evaluations completed as part of the Brent Spence Bridge Corridor Study (BSBC) from 2013 to 2022 and the Brent Spence Strategic Corridor Study (Strategic Corridor) in 2017. A summary of these traffic evaluations is listed below:

- 2013-2015 (BSBC): Traffic Forecasting, Travel Demand Modeling, and Traffic Operations Analysis using HCS and VISSIM. The study focused on the traffic impacts of tolling the BSB.
- 2017 (Strategic Corridor): Traffic count collection, Travel Demand Modeling, and Traffic Operations analysis with TransModeler. The study included the development and evaluation of the Brent Spence Bridge bypass concepts, including the Cincinnati Eastern Bypass.
- 2019-2020 (BSBC): TransModeler analysis of value engineering concepts; Concept I-W and Concept I-M were part of this study. The planning level evaluation was based on forecasted 2040 toll-free traffic volumes developed for Alternative I in 2015. A detailed alternative analysis using the OKI travel demand model was not completed for this study.
- 2021-2022 (BSBC): Refined Alternative Level forecasts and TransModeler analysis was completed for Concept I-W and Alternative I. The TransModeler models were calibrated to standards outlined in the OATS manual. The findings of this study indicated Concept I-W had similar traffic operations to Alternative I and was moved forward as the preferred alternative.

Since completing the value engineering analysis in 2022, the project team has been coordinating with FHWA on the traffic analysis for the Interchange Modification Study (IMS) addendum. This addendum compares Alternative I to Alternative I-W. The traffic analysis includes certified traffic forecasts for 2029 and 2049, a safety analysis, and TransModeler operations analysis. Through coordination with FHWA, ODOT, and KYTC, it was determined that the project should update the TransModeler calibration to achieve agreed-upon calibration standards as outlined in the BSB Methods and Assumptions Memorandum. As part of the updated calibration, the project team completed a cluster analysis and developed calibration targets for travel time and vehicle throughputs on the BSB. This updated calibration report outlines the cluster analysis, calibration targets for travel time and throughput, and the calibration parameters used in TransModeler. It explains how these parameters will be applied to future models. The TransModeler calibration for the value engineering study has additional details on model development and can be referenced at BSB_Traffic_Operations_Report_Final.pdf (brentspencebridgecorridor.com). The TransModeler project limits are shown in Figure 1.

Figure 1: TransModeler Project Limits



2. METHODOLOGY

The TransModeler models were developed following guidelines from the *ODOT Analysis and Traffic Simulation Manual: Traffic Simulation with TransModeler,* KYTC TransModeler guidance, and agreed-upon calibration methodologies outlined in the BSB Traffic Methods and Assumption Memorandum. The model development procedures are outlined below.

1) Existing Model Network Development:
    a. The study team started with the Existing 2019 model prepared for the BSB value engineering study in 2022. This model was modified from a model developed by Caliper in 2020, for the Connected Autonomous Vehicle (CAV) analysis. During the development of the value engineering model, the link grades were reviewed and updated to be consistent with the criteria outlined in the OATS manual. The OATS manual recommends entering grades on freeway links with grades greater than 2% and on arterial links greater than 3%. The team did not calibrate model driving parameters that are directly related to grade and vehicle performance, but instead relied on the default TransModeler parameters. However, the team added headway buffers for I-71/75 in Kentucky to calibrate volume throughput and travel time. These adjustments apply to the roadway segments with the most severe grades in the project corridor. **Section 6** provides a more detailed description of the calibration adjustments.
    b. The TransModeler network was adjusted to match the IMS limits.
    c. Minor calibration adjustments from the value engineering model with additional applications of local headway buffers.
2) Cluster Analysis
    a. A cluster analysis was completed using methodologies agreed upon by all stakeholders to determine a representative day.
    b. Data inputs include:
        i. I-71/75 Travel times collected by INRIX and available through the National Performance Management Research Data Set (NPMRDS)
        ii. Volume throughput on BSB
        iii. Precipitation
        iv. Crashes
    c. Analysis timeframe is May 28, 2019 to October 25, 2019
3) Volume Development
    a. As part of the value engineering study completed in 2022 the following steps were completed:
        i. Traffic counts from 2017 – 2021 were reviewed for the project corridor, and count target volume values were selected.
        ii. The selected traffic volumes are used as inputs in an origin-destination (O-D) matrix estimation
        iii. Model periods were defined as 6:00-10:00 AM and 2:00-7:00 PM to capture the full extent of peak period travel delays. Each model also includes a 30-minute warmup.

iv. Existing O-D matrices were developed for three vehicle classes in 15-minute bins.
    1. Autos
    2. Single Unit Trucks
    3. Articulated Trucks
v. Project-specific vehicle fleet information was developed using traffic counts and recommendations from ODOT and KYTC manuals.

b. For the IMS calibration update, the BSB volume throughput was established using the representative day identified in the cluster analysis. The O-D matrices were modified from the models created in 2022 to achieve travel time and volume throughput calibration targets.
c. The volumes used for the Existing 2019 TransModeler calibration were also used to establish balanced peak hour volumes, which are used within the certified traffic process to forecast opening year and design year traffic volumes.

4) Existing Model Calibration
    a. Cluster analysis used to identify a representative day
    b. The calibration methodology agreed upon by all stakeholders uses two measures of effectiveness (MOE's):
        i. I-71/75 travel time
        ii. BSB vehicle throughput

3. CLUSTER ANALYSIS

Cluster analysis (or clustering) of daily traffic data groups a set of days into distinct groups with similar traffic characteristics. Clustering is commonly used in transportation network analysis to detect data patterns and trends. Cluster analysis is a form of unsupervised learning that can be performed using different algorithms. The k-means technique is one of the most common approaches for cluster analysis. The k-means algorithm aims to group *n* observations into *k* clusters, in a way that each observation is allocated to the cluster with the closest mean. The allocation is done by minimizing the sum of squared distances between the data points and the cluster centroids.

This study employed the k-means technique to perform a cluster analysis for day-to-day traffic data of the Brent Spence Bridge. The study examined the traffic attributes of the duration between May 28 and October 25, 2019. The study excluded data from days June 3 - 8 and August 31 due to incomplete volume data. Two models were developed for the AM and the PM peak periods. The AM peak period was defined as the period from 6:00 to 10:00 AM. The PM peak period was defined as 2:00 to 7:00 PM. The cluster analysis followed the most recent guidelines provided by the U.S. Department of Transportation, as presented in Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software (April 2019).

The purpose of clustering for the BSB project is to identify an AM and PM primary cluster that describes the most common traffic conditions in the corridor. From the primary clusters, a representative day is selected for

each peak period that best describes the average condition in that primary cluster. The representative days selected do not have a reported crash within the I-71/75 freeway limits.

The clustering process was performed using the following steps.

Step 1: Attributes Identification:

The first step of the analysis aimed to identify the attributes impacting travel conditions. The analysis included key traffic attributes, significantly defining the travel conditions on the Brent Spence Bridge corridor. The examined attributes included precipitation, number of crashes, average travel time, and traffic volumes for northbound (NB) and southbound (SB) directions separately.

Precipitation data was collected from the Automated Surface Observing System (ASOS) program. The modeling included precipitation data from the Cincinnati/Lunken (LUK) weather station of the Ohio ASOS Network. The precipitation variable in the modeling was the cumulative precipitation levels in inches during the peak period (AM or PM) on a given day.

Crashes are defined by the number of total crashes observed in each freeway direction during the period of analysis. The average travel time variable represents the directional travel time on the corridor in the study limits, averaged across the peak period. The traffic volume was considered as the cumulative directional traffic volume during the peak period.

In summary, seven attributes were considered for the analysis, and they are defined as follows:

Precipitation, Crash Counts NB, Crash Counts SB, Travel Time NB, Travel Time SB, Traffic Volumes NB, and Traffic Volumes SB.

Step 2: Data Processing:

All attributes considered in the analysis were quantitative variables, with no need for further transformation. The analysis proceeded to the next step with data normalization.

Step 3: Data Normalization:

The third step of the process is to normalize the examined data. Data normalization is a critical step to ensure the validity of the process. Normalization is performed by converting the data to a common scale for all attributes. The normalization equation is presented as follows:

$$x' = a + \frac{(x - x_{min})(b - a)}{x_{max} - x_{min}}$$

where:

x': normalized value of data *x*

x_{min}: minimum value for the attribute

x_{max}: maximum value for the attribute

a: minimum value of common scale

b: maximum value of common scale

All attributes were normalized to a 0 to 1 common scale, except for traffic volume and travel time for the peak direction, which were normalized to a 0 to 2 scale. The peak direction of the AM period was NB, while it was SB for the PM period. The different scale for traffic volume and travel time for the peak direction adjusts for a higher weight for these attributes. Higher weights reflect the significance of these characteristics in traffic conditions.

Step 4: Attributes Down Selection:

This step aims to filter out redundant variables that do not impact the key measure of interest (travel time) or are highly correlated with other attributes. The variables were tested for multicollinearity, and the correlation matrix was developed. The correlation matrix presented that the examined attributes were not highly correlated, and all correlation factors were less than 0.8.

Additionally, a variance inflation factor (VIF) test was performed to check for multicollinearity. The VIF evaluates the variance inflation of a regression coefficient due to multicollinearity in the model. The VIF values were all far below 5, which indicates that multicollinearity is not an issue. Therefore, the cluster analysis was performed with the full set of examined attributes.

Step 5: Cluster Performing:

The cluster analysis was performed using the k-means technique. The k-means algorithm requires defining the number of clusters (k) for the analysis. The initial number of clusters was specified as 3. This technique aims to minimize the sum of squared distances (Euclidean distance) between the normalized data points and the cluster centroids. The following formula calculates the Euclidean distance for each data point and the cluster centroid:

$$xdis_y = \sqrt{(x_1 - ymean_1)^2 + (x_2 - ymean_2)^2 + (x_3 - ymean_3)^2 + \cdots}$$

where:

$xdis_y$: distance of data *x* to mean of cluster *y*

x_1: value corresponding to attribute 1 for data *x*

ymean$_a$: mean value for attribute *a* for cluster *y*

The data points examined in the analysis included the seven traffic attributes, described in step 1. The cluster analysis was performed using R statistical software, particularly by the "kmeans" function.

Step 6: Stopping Criterion Identification:

The initial cluster size was set as k = 3, while the maximum cluster size was calculated as:

$$k = 2 * \sqrt{n/2}$$

Where n is the number of days. The maximum cluster size was calculated as 18.

The R package "NbClust" was utilized to determine the optimal number of clusters for the model. This package follows a set of 30 unique indices to optimize the number of clusters. The "NbClust" tallies the results and promotes k with the most votes as the optimal number of clusters.

Results: AM Peak

The clustering results revealed that four was the optimal number of clusters for the AM peak period. Cluster 3 is selected as the primary cluster as it includes the most days (71 days). The representative day was selected from the primary cluster based on a combined evaluation that included travel time and traffic volumes. The goal of the representative day selection was to find a day that best matches the average condition within the primary cluster and does not have reported crashes. The representative day of the AM period was selected as Wednesday, June 26, 2019.

The number of days for each cluster was identified as follows:

Table 1: Number of Days for each Cluster (AM Peak)

Cluster Number	Number of Days
1	21
2	10
3	71
4	42

The traffic volumes of the AM peak period ranged from 6,272 to 22,494, with an average of 17,353 vehicles. For the SB, the traffic volumes ranged from 5,809 to 18,198, with an average of 14,098 vehicles. The representative day's volumes were 20,627 for NB and 16,330 for SB. Figure 2 and Figure 3 illustrate the AM peak period traffic volumes for NB and SB.

For the AM peak period, the NB travel times ranged from 10.7 to 45.6, with an average of 16.8 minutes. For the SB, the travel times ranged from 10.6 to 21.9, with an average of 11.6 minutes. The representative day travel times were 17.8 and 11.4 minutes for NB and SB, respectively. Figure 4 and Figure 5 represent the daily AM peak travel times for NB and SB.

The following section discusses the traffic attributes of each cluster, with the distinctive characteristics highlighted in the header:

Cluster 1 (Lower travel times on NB and all days had crashes for SB I-71/75)

Cluster 1 includes weekday data points with the following characteristics:

- NB: Average to high traffic volumes, relatively lower travel times, and many days experienced crashes.
- SB: Mixed traffic volumes, mixed travel times, and crashes on all days.
- Most days didn't experience precipitation.

Cluster 2 (High travel times and crashes on NB)

Cluster 2 includes weekday data points with the following characteristics:

- NB: relatively lower traffic volumes, higher travel times, and crashes are experienced almost daily.
- SB: relatively lower traffic volumes, lower travel times, and most days didn't experience crashes.
- Half of the data points in this cluster experienced precipitation.

Cluster 3 - Primary Cluster (High volumes and no crashes on SB)

Cluster 3 is the primary cluster and includes weekday data points with the following characteristics:

- NB: relatively higher traffic volumes, lower travel times, and many days experienced crashes.
- SB: higher traffic volumes, relatively lower travel times, no crashes.
- Most days in this cluster didn't experience precipitation.

Cluster 4 (weekends)

Cluster 4 includes data points for the weekends with the following characteristics:

- NB: The lowest traffic volumes, the lowest travel times, and almost all data points had no crashes.
- SB: The lowest traffic volumes, the majority had the lowest travel times, and almost all data points had no crashes.
- A considerable number of days had precipitation.

Figure 2: Traffic Volumes for NB (AM Peak)

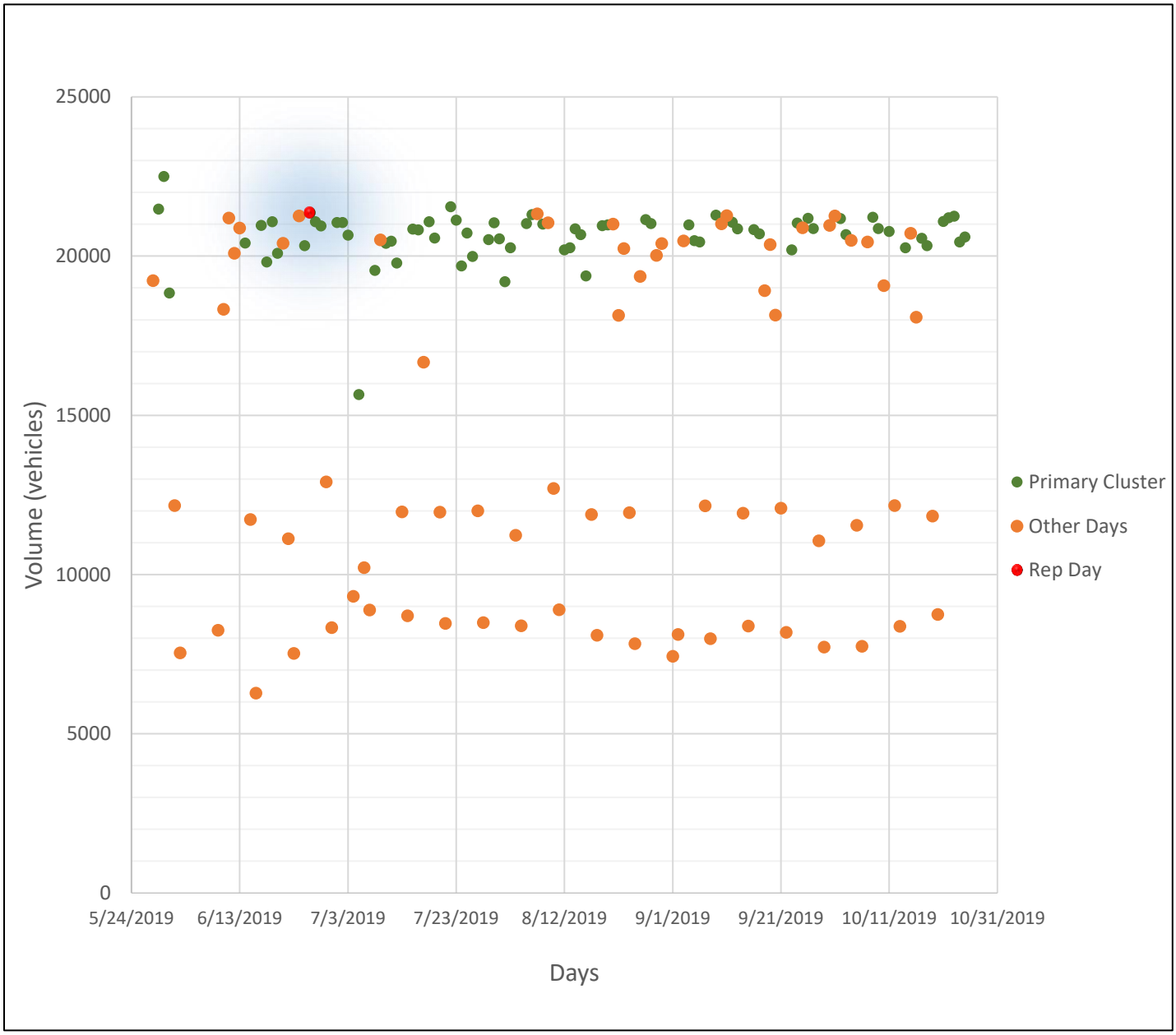


Figure 3: Traffic Volumes for SB (AM Peak)

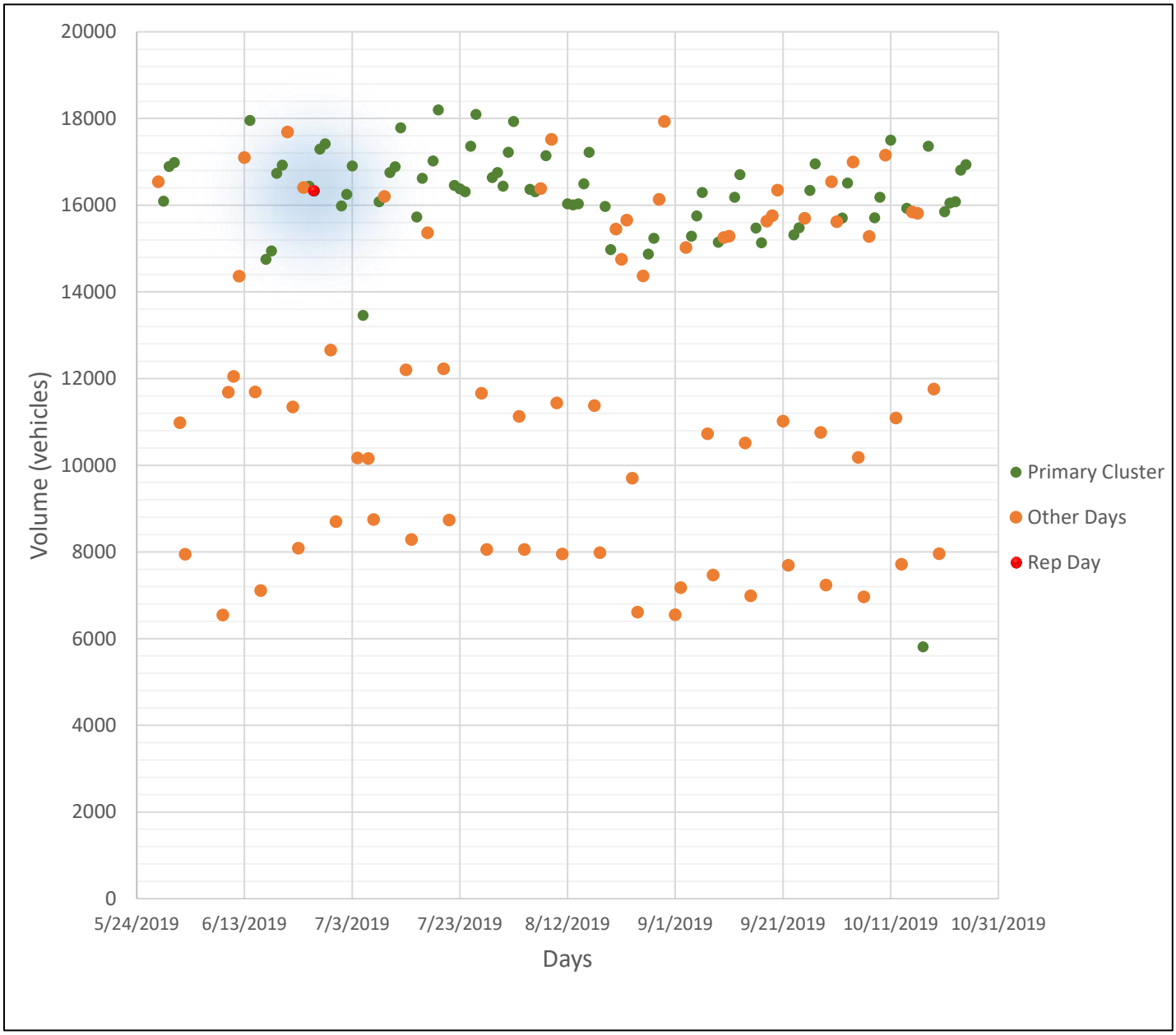


Figure 4: Travel Times for NB (AM Peak)

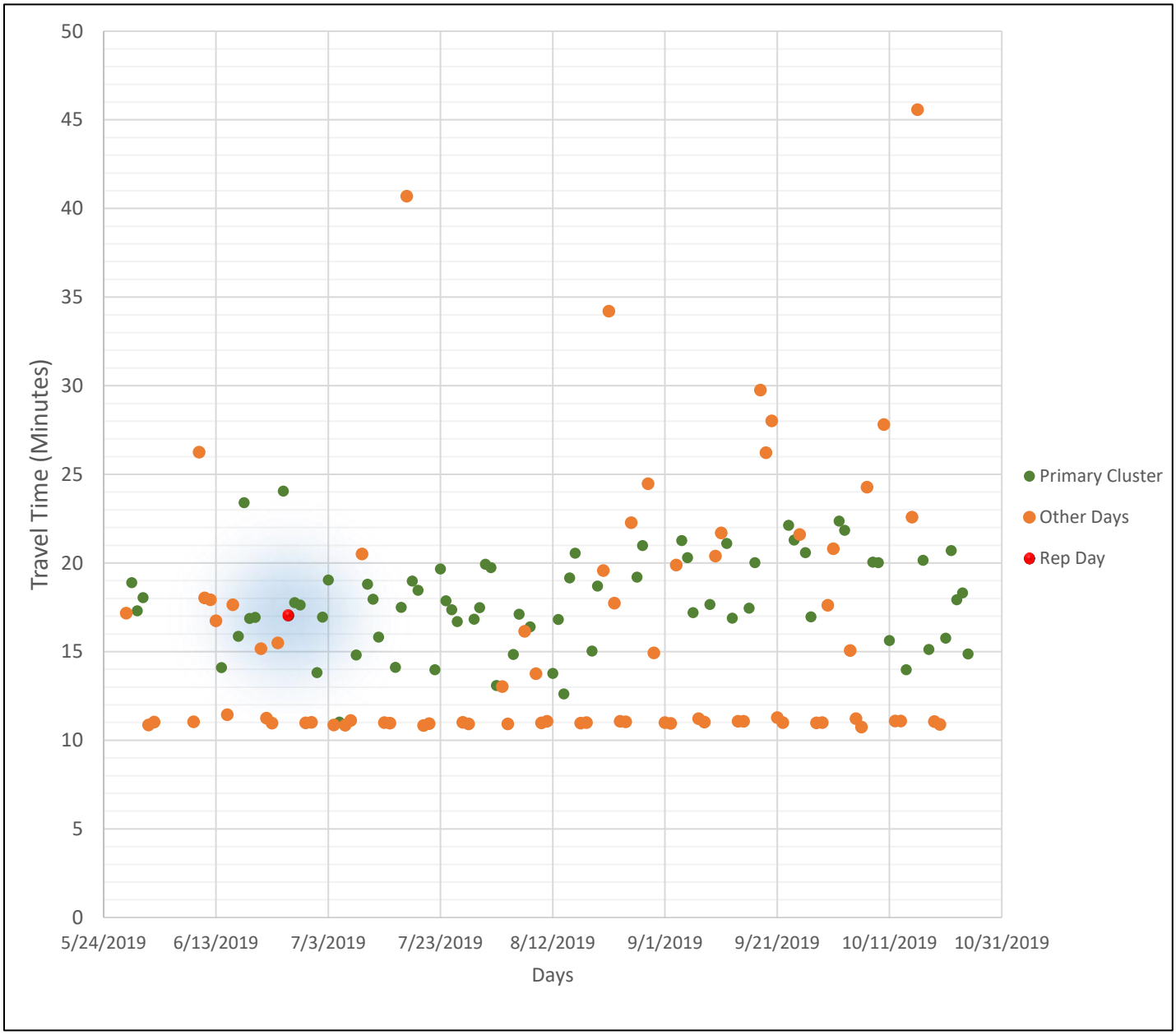
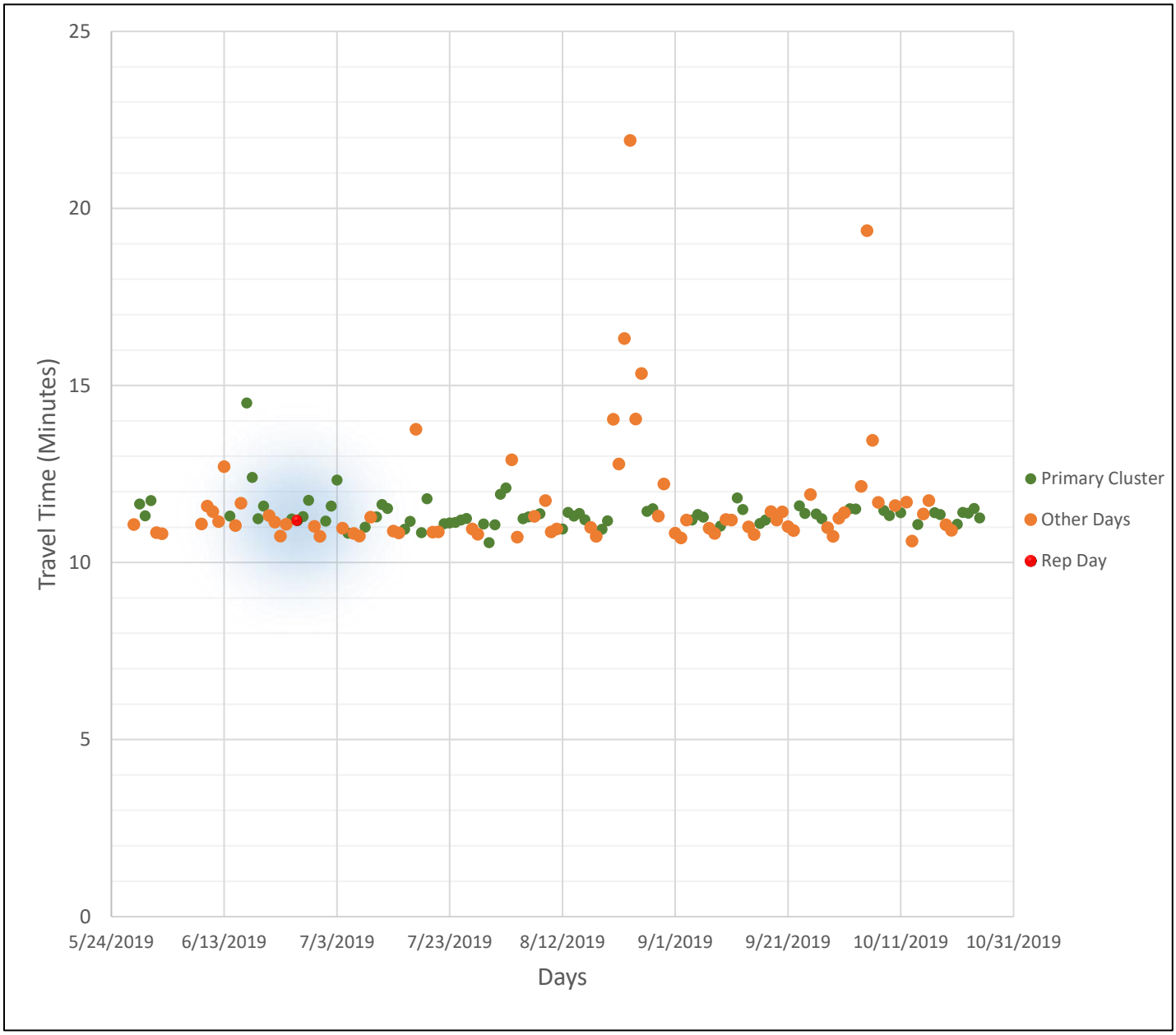


Figure 5: Travel Times for SB (AM Peak)



Results: PM Peak

The optimal number of clusters for the PM peak period was identified as three, and cluster 2 was found to be the primary cluster with 85 days. Based on the combined evaluation of volume and travel time, the representative day for the PM period was selected as Thursday, August 15, 2019. This day has volume and travel time conditions closest to the mean of the days in the primary cluster and has no reported crashes.

The number of days for each cluster was identified as follows:

Table 2: Number of Days for each Cluster (PM Peak)

Cluster Number	Number of Days
1	41
2	85
3	18

For the PM peak period, the NB volumes ranged from 17,912 to 25,717, with an average of 23,318 vehicles. For the SB, the traffic volumes ranged from 17,440 to 28,868, with an average of 25,599 vehicles. The traffic volume for the representative day was 23,647 for NB and 27,547 for SB. Figure 6 and Figure 7 illustrate the daily PM peak traffic volumes for NB and SB.

For the PM peak period, the NB travel times ranged from 11.1 to 29.2, with an average of 16.4 minutes. For the SB, the travel times ranged from 10.9 to 44.3, with an average of 20 minutes. The travel times for the representative day were 16.3 and 22.2 minutes for NB and SB, respectively. Figure 8 and Figure 9 represent the daily PM peak travel times for NB and SB.

The following section discusses the traffic attributes of each cluster, with the distinctive characteristics highlighted in the header:

Cluster 1 (weekends)

Cluster 1 includes data points of weekends with the following characteristics:

- NB: High traffic volumes, relatively low travel times, a considerable number of days experienced crashes.
- SB: Average traffic volumes, the lowest travel times, a noticeable number of days experienced crashes.
- Most days didn't experience precipitation.

Cluster 2 – Primary Cluster (High traffic volumes and considerable crash counts on both directions)

Cluster 2 is the representative cluster and includes weekday data points with the following characteristics:

- NB: relatively high traffic volumes, relatively low travel times, and many days experienced crashes.
- SB: High traffic volumes, average travel times, and half of the days experienced crashes.

- A noticeable number of days experienced precipitation.

Cluster 3 (High crash counts on both directions)

Cluster 3 is the representative cluster and includes weekday data points with the following characteristics:

- NB: Mixed traffic volumes, mixed travel times, most days experienced crashes.
- SB: Mixed traffic volumes, higher travel times, and almost all days experienced crashes.
- Half the data points experienced precipitation.

Figure 6: Traffic Volumes for NB (PM Peak)

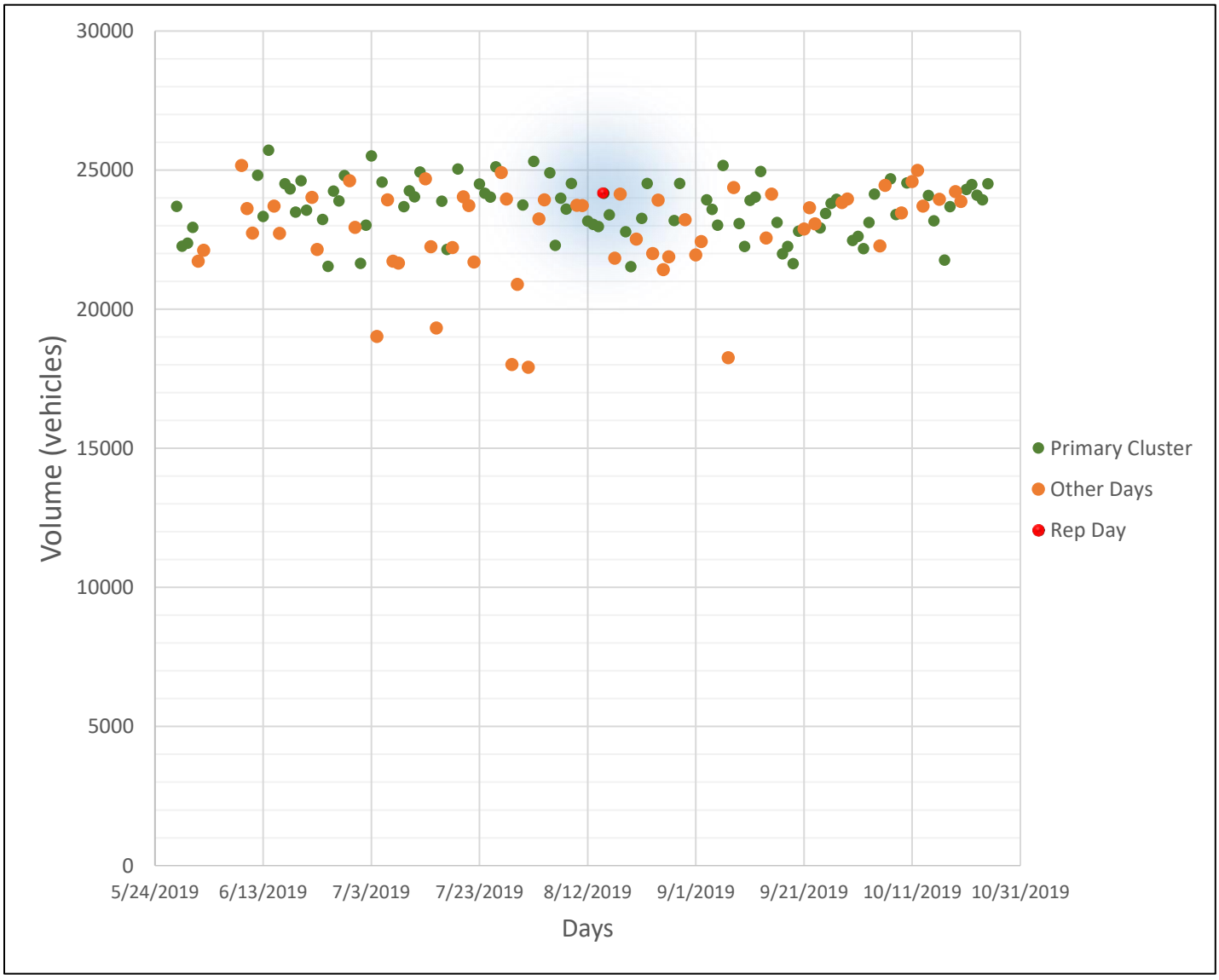


Figure 7: Traffic Volumes for SB (PM Peak)

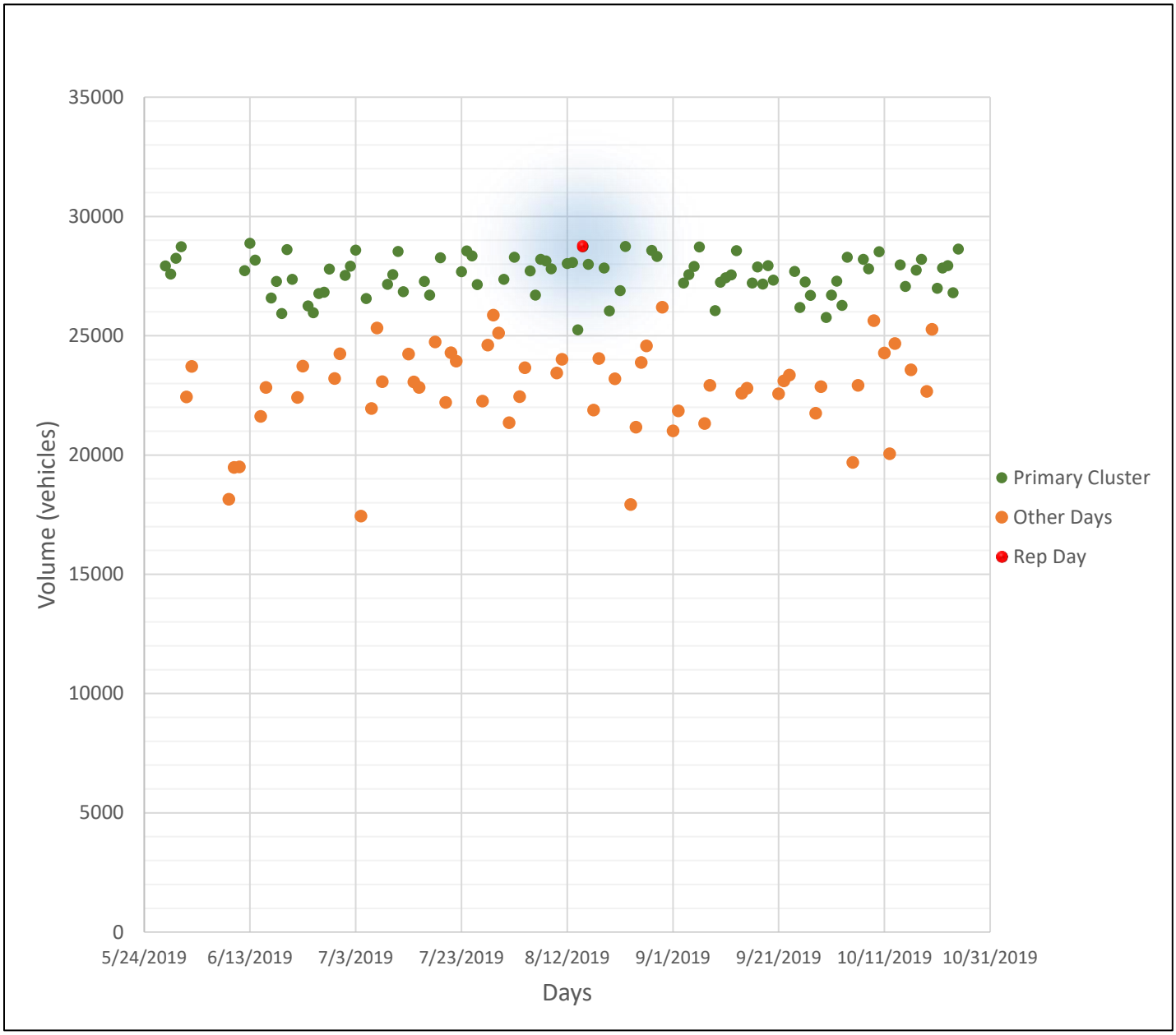


Figure 8: Travel Times for NB (PM Peak)

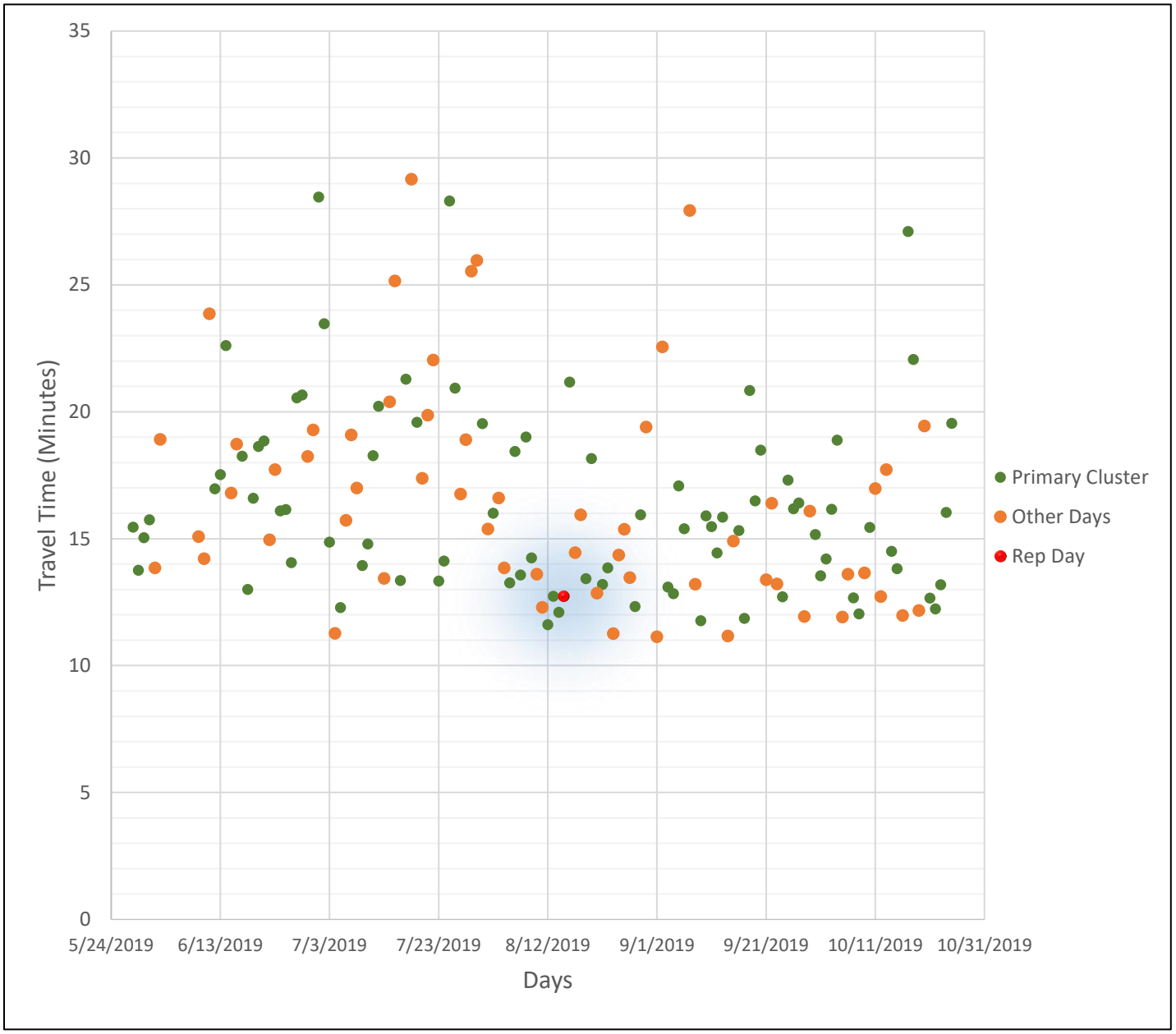
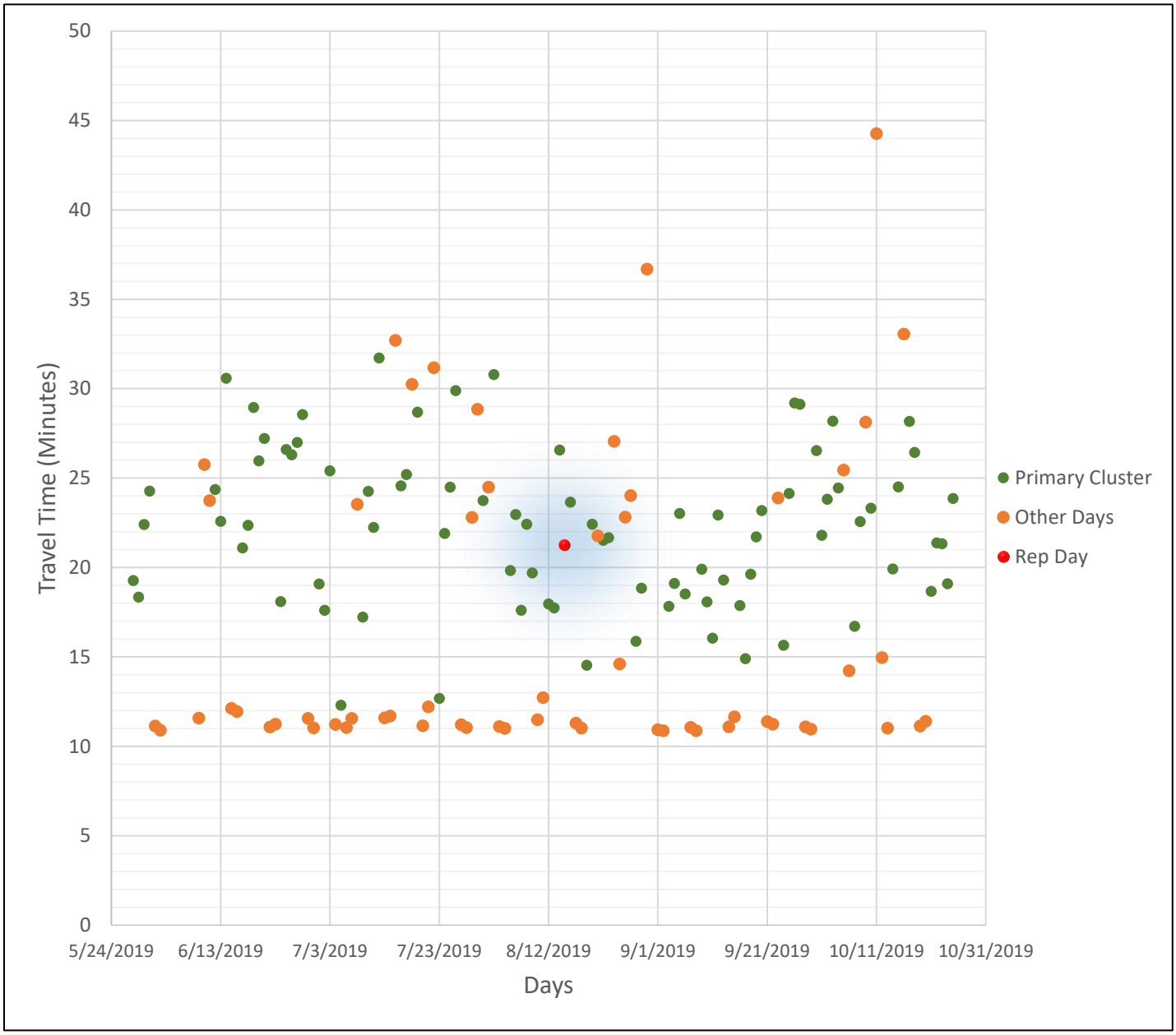


Figure 9: Travel Times for SB (PM Peak)

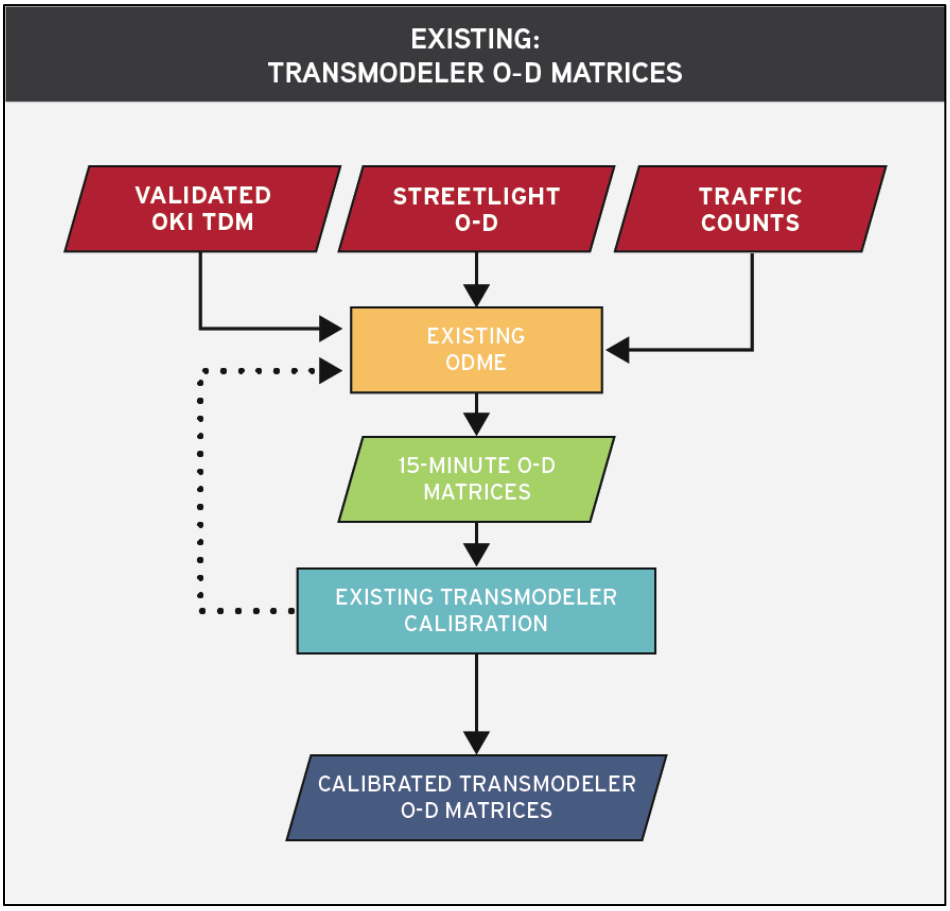


4. VOLUME DEVELOPMENT

4.1 Overview

As part of the 2022 value engineering study, the Existing 2019 TransModeler traffic inputs for the AM and PM peak periods were developed based on AM and PM peak period pattern O-D matrices from the OKI travel demand model, and all available traffic counts between 2017 and 2022. The BSB counts for the representative days were inserted in this process instead of the averaged count data used in the value engineering study. An overview of the O-D development process is described in the flow chart shown in Figure 10. The Origin-Destination Matrix Estimation (ODME) is an iterative process with a feedback loop between TransModeler simulation runs and O-D trip table adjustments as show in the O-D development flow chart. The O-D matrices were adjusted through the iterative process to achieve the IMS calibration targets for the throughput on the Brent Spence Bridge and corridor travel time on I-71/75.

Figure 10: Existing 2019 O-D Development



4.2 ODME Methodology

The existing TransModeler O-D matrices are developed using an ODME approach, implemented by HNTB with the R scripting language, that applies an entropy maximization technique through iterative matrix factoring. The goal of the ODME is to derive 15-minute O-D matrices by vehicle classifications that best fit the count data (link and turning movements), and the anticipated trip pattern distributions at the interchanges and freeway ramp-to-ramp movements. The TransModeler network structure allows for a practical application of all-or-nothing traffic assignment, as there is one clear shortest path between every O-D pair. This condition is optimal for the proposed ODME process, which assigns a skim matrix for each traffic count location. A skim matrix defines the O-D trips that traverse a particular point in the network. The assigned skim matrices are the basis of the ODME factoring algorithm, which iteratively factors the pattern matrices by O-D pairs using the skims and the traffic count targets. An O-D pattern fitting procedure follows each round of count factoring to preserve the underlying trip distributions. The final estimated matrices are derived using the method of successive averages, which combines the results of each factoring iteration. An override factor is applied to the Brent Spence Bridge traffic counts to prioritize these counts as they are the representative day selected during the cluster analysis.

A key input for the ODME is a pattern O-D matrix. The project team reviewed Streetlight and extracted O-D matrices from the OKI model. Both data sets are suitable as pattern O-D matrices; however, it was agreed during the value engineering study that the OKI model is a better choice in this situation, as the growth rates are developed using the OKI travel demand model. The Streetlight O-D was used to validate the OKI data and to distribute the initial 15-minute matrix within the ODME process. The ODME steps are listed below.

Step 1: Estimate Period O-D Matrices

Total vehicle O-D matrices are estimated for 6-10 AM and 2–7 PM. The ODME uses directional link and turning movement traffic counts as targets. O-D period pattern matrices are extracted from the OKI travel demand model. Streetlight for the AM and PM periods is also reviewed and serves as a secondary source of O-D data. The Streetlight query details for these matrices include:

- Hours: 6-10 AM; 2-7 PM (separate queries)
- Year: 2019 (12 months)

This first step resulted in AM and PM period matrices for total trips. These matrices best fit the available link and turn count data while also maintaining pattern and overall trip distribution targets.

Step 2: Develop Temporal Distribution of Trip Tables

The 15-minute trip tables are developed from the total peak trip tables. This procedure develops proportioning tables that best match the static assignment of each of the target link counts. The initial proportions are identified by O-D pairs using Streetlight data and then factored to best match available count data temporal distributions.

Step 3: Develop Classification Trips Tables

The 15-minute O-D matrices are divided into three classifications: autos, single-unit trucks, and articulated trucks. The matrices are proportioned by O-D cell into the three classifications. The proportioning procedures use an iterative factoring algorithm that seeks the best fit to the count classification data. The initial estimate of the proportional matrices is based on the classification of O-D matrices from the OKI model.

Step 4: Feedback Loop with TransModeler Assignment and Table Adjustments

TransModeler is simulated with the initial matrices from Step 3. The convergence on count targets and operation metrics is evaluated. The proportioning tables from Step 3 were revisited, and the temporal distributions of trips were iteratively refined to meet calibration targets. The existing trip table temporal distributions are used for the 2049 TransModeler O-D development. In some cases, the total O-D pair demand in the step 4 matrices is higher than the matrices generated in Step 3. This is the case for the BSB traffic demand in the peak direction. Figure 11 and Figure 12 summarize the BSB throughput volume target (that is the basis for the Step 3 demand) to the adjusted demand generated during the calibration of TransModeler. As you can see, there is traffic demand that is higher than the throughput on the BSB. In the AM peak, the model was calibrated with extra demand at the beginning of the period, while the PM peak period is calibrated to have some extra demand throughout most of the period.

Figure 11: NB I-71/75 Traffic Demand versus Throughput in AM Period

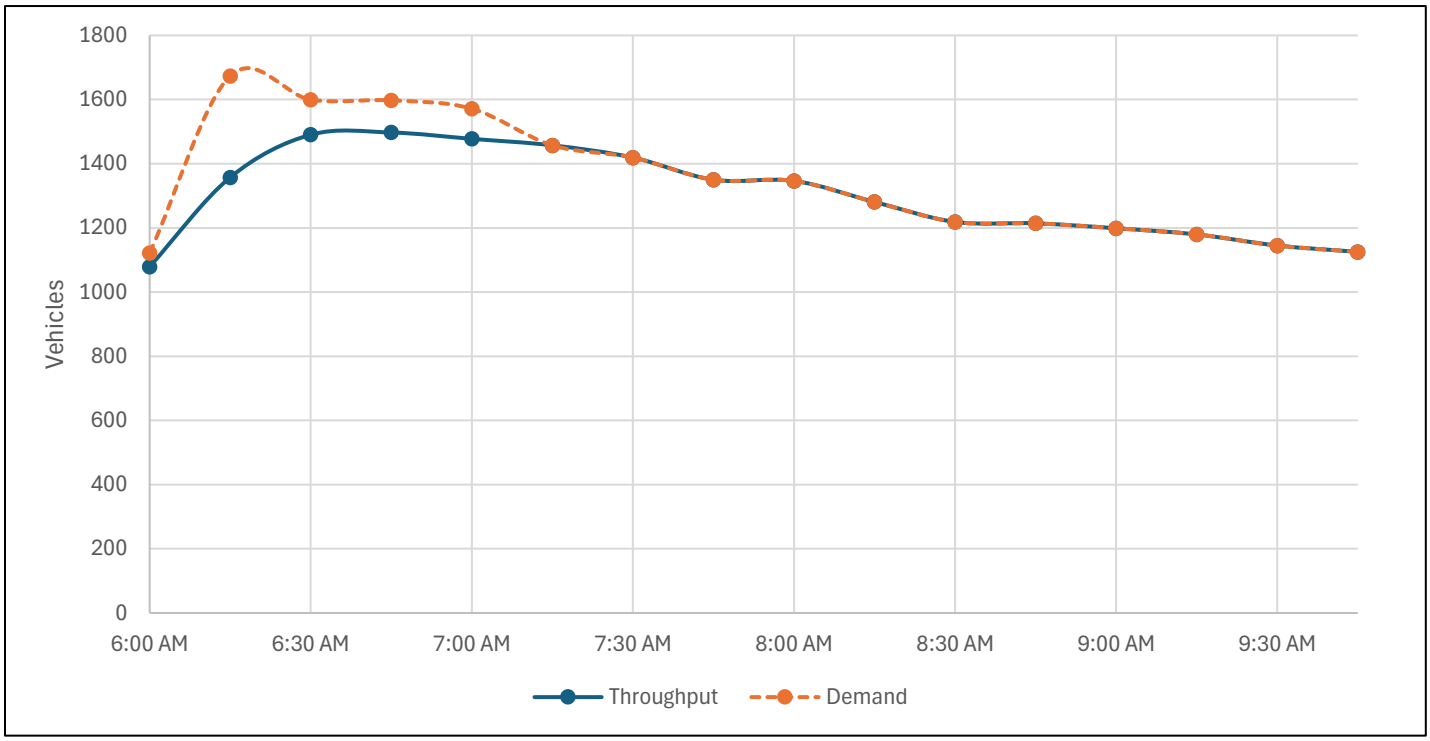
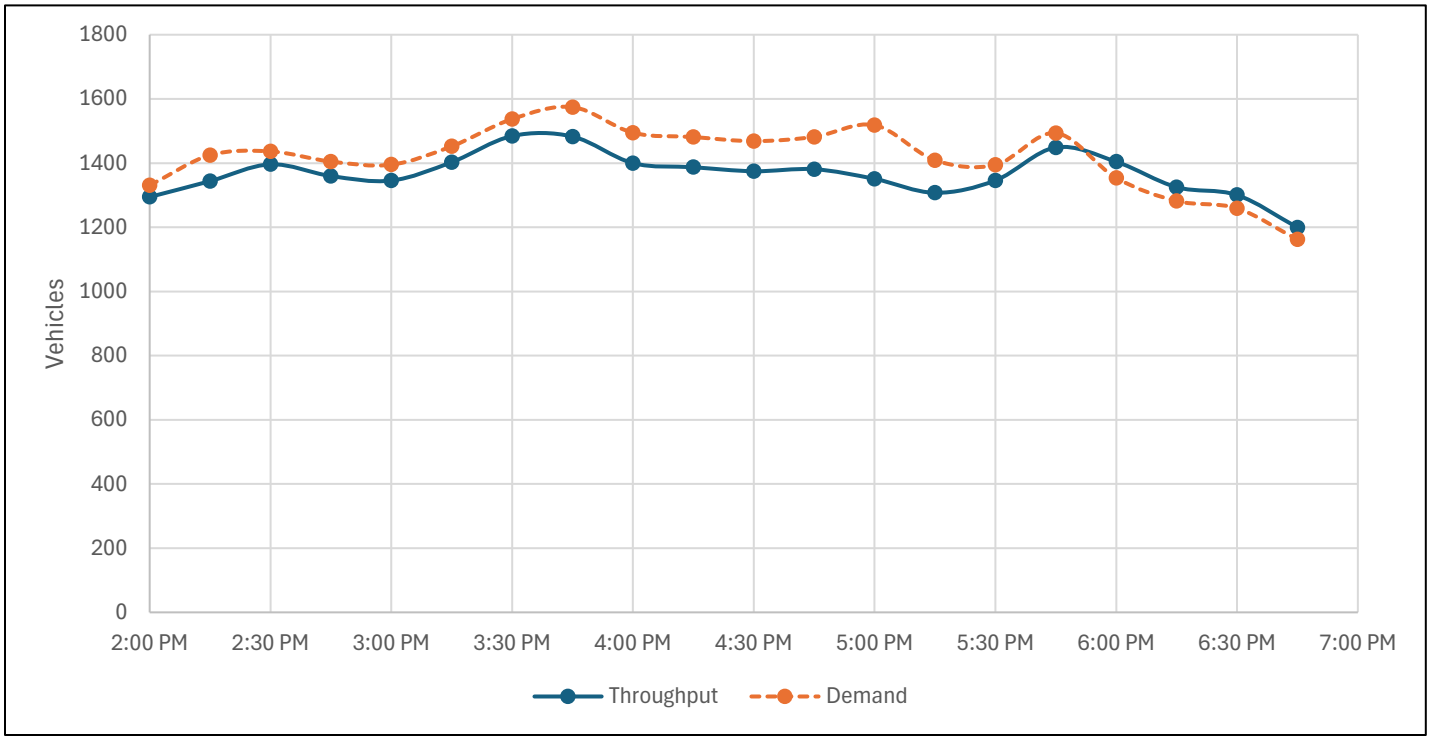


Figure 12: SB I-71/75 Traffic Demand Versus Throughput in PM Period



4.3 Comparison to Value Engineering Study

The O-D matrices for Existing 2019 do not deviate significantly from the ones used in the Value Engineering study. A scatter plot comparing the O-D pair volumes at the period level before and after the calibration adjustments are shown in Figure 13 (AM) and Figure 14 (PM). The volume adjustments were an iterative process, with changes to network calibration parameters to achieve the calibration targets. As shown in the figures, the changes to period volume from the previous TransModeler analysis are minimal. The two outliers in the PM scatter plot are internal trips on 4th Street in Kentucky, which were reduced to offset increases in traffic to other destinations on I-71/75. These volume reductions will not impact the forecasted volumes used for the Alternative I and Alternative I-W alternative analysis.

Figure 13: O-D Pair Comparison – AM Period

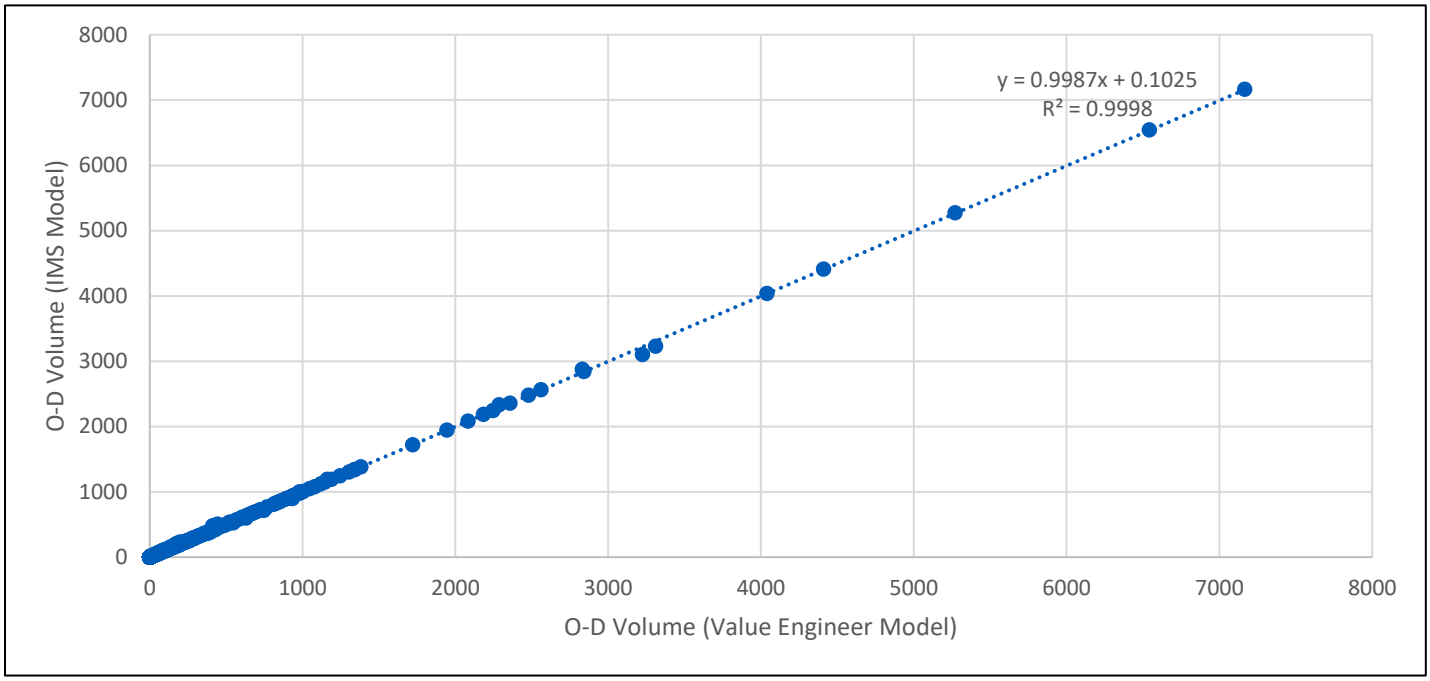
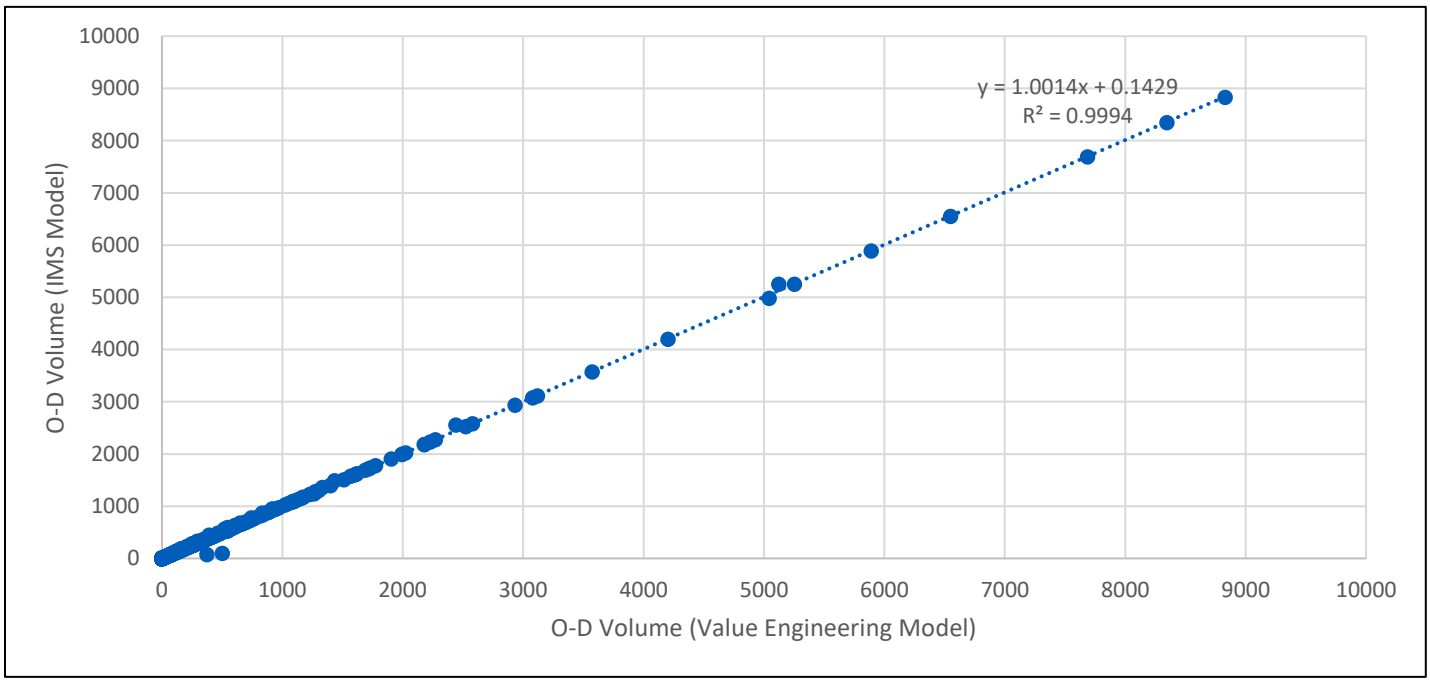


Figure 14: O-D Pair Comparison – PM Period



5. EXISTING MODEL CALIBRATION

5.1 Model Characteristics

Software: TransModeler 6.1

Model Durations:

- AM Period 6:00 – 10:00 AM with 30-minute warmup
- PM Period: 2:00 – 7:00 PM with 30-minute warmup

Car Following Model: Modified General Motors

Traffic Demand Inputs: O-D Matrices in 15-minute bins by auto, SU trucks, and articulated trucks

Link Grades: Per ODOT standards, freeway links with grades of 2% or greater are included, other freeway links are set to 0%. Arterial roads with 3% or greater are included in the model with all other links set to 0%.

Calibration Considerations

- Temporal Distribution of Traffic Demand
- Vehicle Fleet Distributions
- Normal Acceleration
- Car Following Model
- Local Headway Buffers

5.2 Calibration Targets

The primary calibration target is the I-71/75 travel times between the I-275 Interchange on the southern extent and the I-74 Interchange on the northern extent. The secondary calibration target is the volume throughput on the Brent Spence Bridge. The calibration criterion agreed upon by all stakeholders is listed below. The calibration results for the AM and PM periods were achieved for both the travel time and volume throughput on the BSB.

Criterion I: Control for Time-Variant Outliers

- Ninety-five percent of simulated outputs fall within the 2 Sigma Band. One data point is allowed to be outside the two sigma bans for data sets that contain fewer than 20 points.

Criterion II: Control for Time-Variant Inliers

- Two-thirds of the simulated results (and both critical time intervals) fall within the 1 Sigma Band for this travel condition.
- The two critical periods are set for the peak direction travel times and the bottleneck throughputs. The travel time critical periods capture the highest travel time and the second-highest non-adjacent travel time. The bottleneck critical time periods capture the onset and dissipation of traffic congestion.

Because these measures relate to bottlenecks, they are only applicable for the peak directions of travel. Non-peak measures are reported for travel time and volume throughput for the other measures.

- The critical travel-time periods for peak direction of travel include:
  - 7:30 AM and 8:00 AM (Northbound AM)
  - 5:15 PM and 5:45 PM (Southbound PM)
- The bottleneck throughput critical periods include:
  - 6:15 AM and 9:00 AM (Northbound AM)
  - 2:30 PM and 6:30 PM (Southbound PM)

Criterion III: Bounded Dynamic Absolute Error (BDAE)

- The average absolute difference between the simulation and the representative day is less than the BDAE.

$$\frac{\sum_t |c_r(t) - \tilde{c}_i(t)|}{N_T} \leq \text{BDAE Threshold}$$

$$\text{BDAE Threshold} = \frac{\sum_{i \neq r} \sum_t \frac{|c_r(t) - c_i(t)|}{N_T}}{N_{cluster} - 1}$$

$c_r(t)$	Observed value of representative day during time interval t
$c_i(t)$	Observed value of non-representative day within the cluster during time interval t
$\tilde{c}_r(t)$	Simulated performance measure during time interval t
N_T	Number of time intervals
$N_{cluster}$	Number of days in the cluster representing this travel condition

Criterion IV: Bounded Dynamic Systematic Error

- The average difference between the simulation and the representative day is less than one third of the BDAE.

5.3 AM Period Travel Time

The AM period travel time calibration is summarized in Table 3, Figure 15, and Figure 16. All four criteria are achieved for the AM period travel time.

Table 3: AM Travel Time Calibration

Test	Description	Criteria	AM Model			
			NB BSB	Criteria Met?	SB BSB	Criteria Met?
Criteria I	95% within 2 Sigma	95%	100%	Yes	100%	Yes
Criteria II	Two thirds within 1 Sigma	66.66%	94%	Yes	94%	Yes
	Critical Time Intervals within 1 Sigma	100%	100%	Yes	100%	Yes
Criteria III	BDAE	3.0/0.4	1.6	Yes	0.2	Yes
Criteria IV	One third BDAE	1.0/0.1	0.8	Yes	0.1	Yes

Figure 15: AM Travel Time NB I-71/75

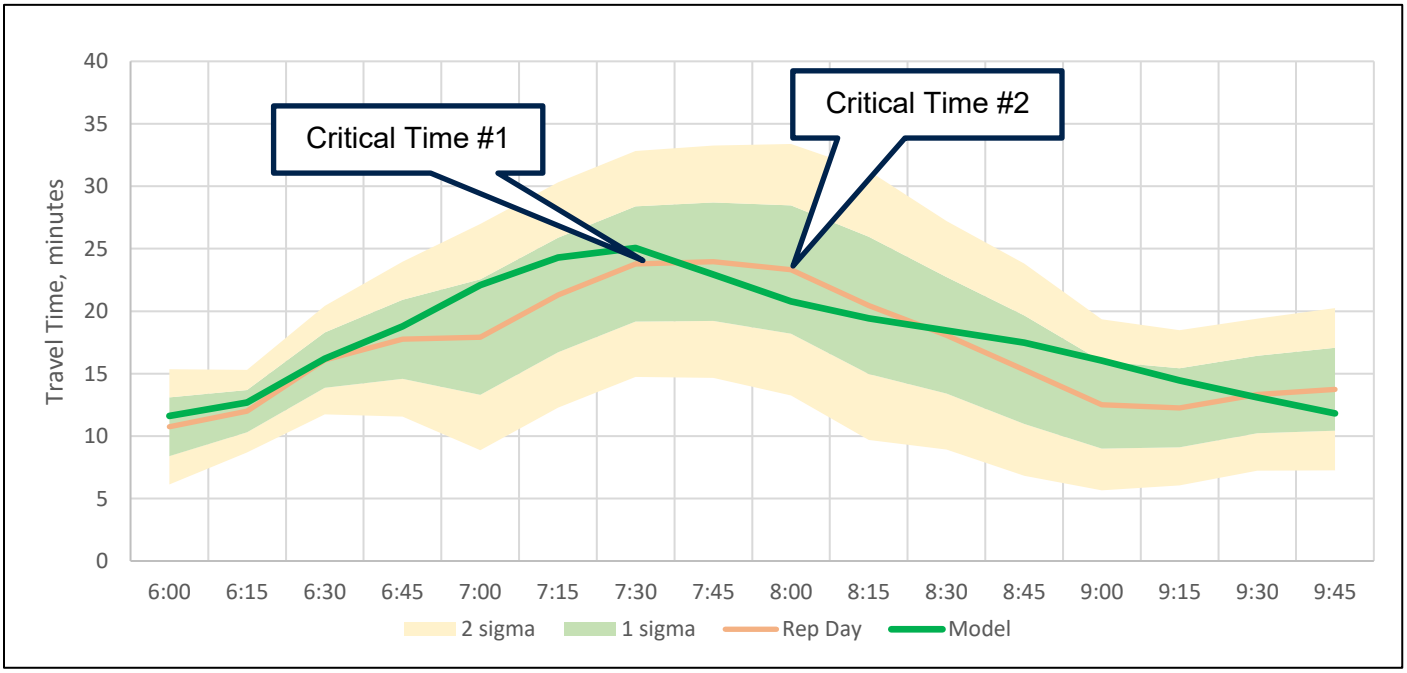
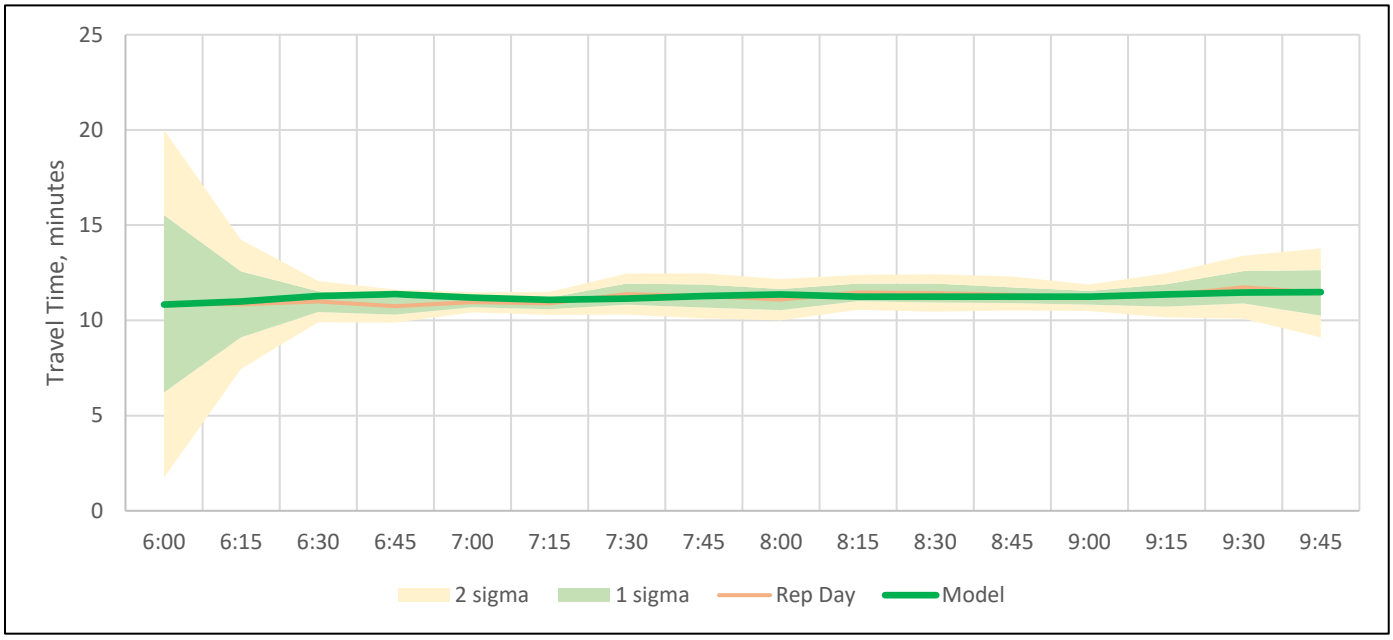


Figure 16: AM Travel Time SB I-71/75



5.4 AM Period Volume

The modeled volume throughput on the BSB was checked against the representative day. The volume calibration was achieved for all four criteria as shown in Table 4, Figure 17, and Figure 18.

Table 4: AM BSB Volume Throughput Calibration

Test	Description	Criteria	AM Model			
			NB BSB	Criteria Met?	SB BSB	Criteria Met?
Criteria I	95% within 2 Sigma	95% (or missing one target)	94%	Yes	100%	Yes
Criteria II	Two thirds within 1 Sigma	66.66%	75%	Yes	100%	Yes
	Critical Time Intervals within 1 Sigma	100%	100%	Yes	100%	Yes
Criteria III	BDAE	97/84 {15-min volume}	51	Yes	47	Yes
Criteria IV	One third BDAE	32/28 {15-min volume}	0.3	Yes	11	Yes

Figure 17: AM NB BSB Traffic Volume

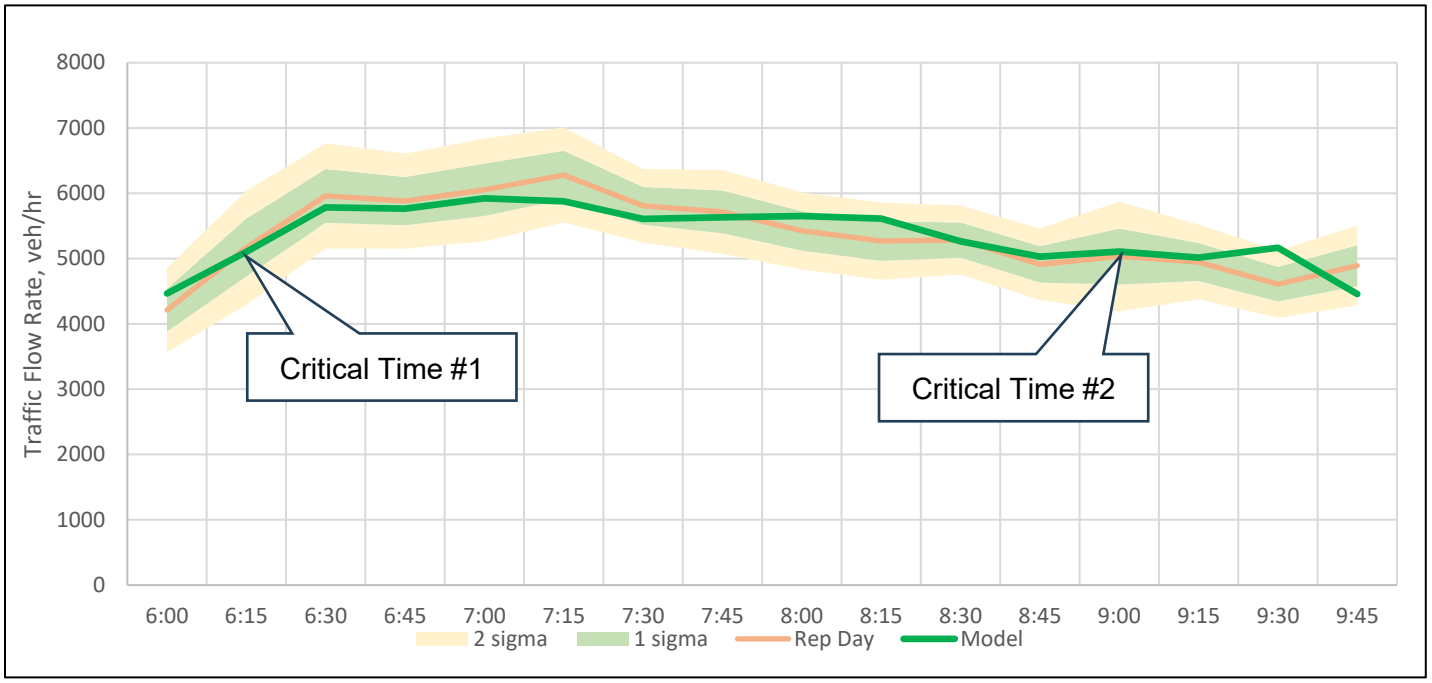
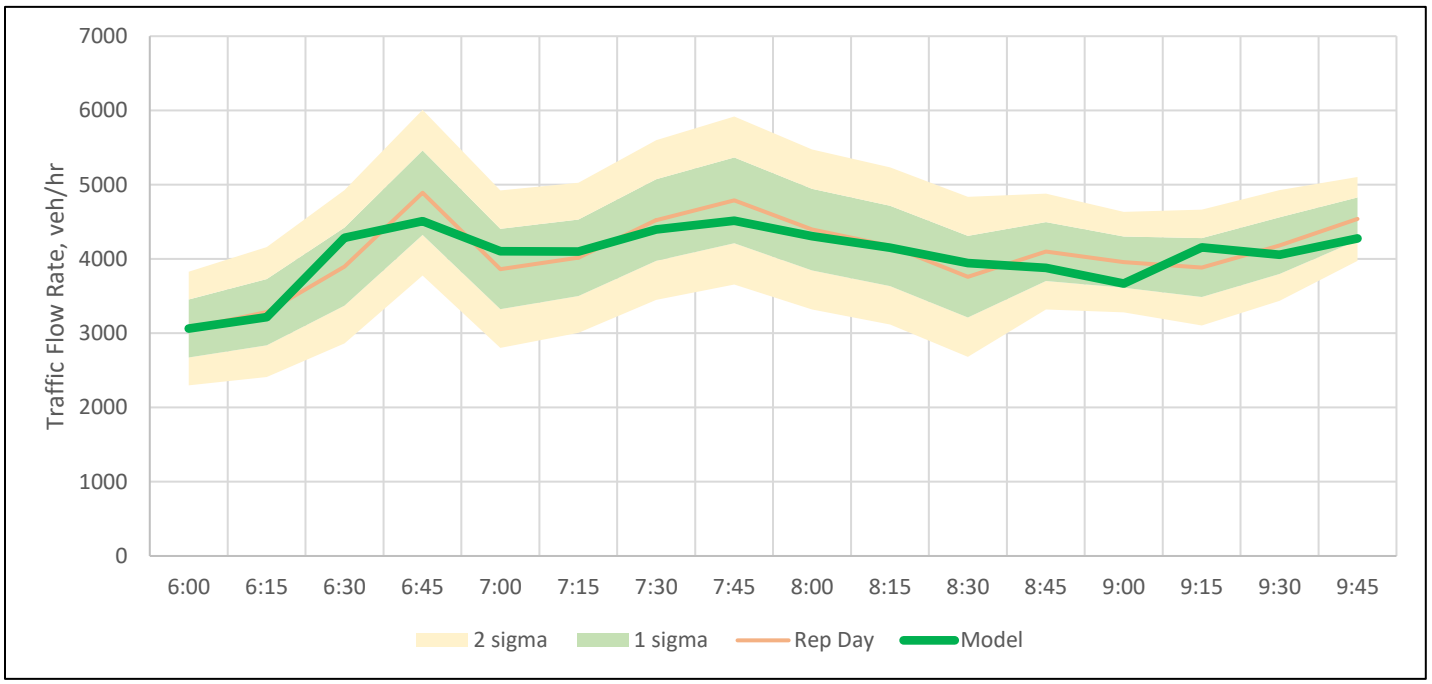


Figure 18: AM SB BSB Traffic Volume



5.5 PM Period Travel Time

The I-71/75 travel time between the I-74 Interchange and the I-275 interchanges was evaluated as the primary calibration target for the PM period model. The model achieves all four criteria as shown in Table 5, Figure 19, and Figure 20.

Table 5: PM Travel Time Calibration

Test	Description	Criteria	PM Model			
			NB I-71/75	Criteria Met?	SB I-71/75	Criteria Met?
Criteria I	95% within 2 Sigma	95%	100%	Yes	100%	Yes
Criteria II	Two thirds within 1 Sigma	66.66%	100%	Yes	100%	Yes
	Critical Time Intervals within 1 Sigma	100%	100%	Yes	100%	Yes
Criteria III	BDAE	4.2/5.0	0.9	Yes	2.4	Yes
Criteria IV	One third BDAE	1.4/1.7	0.8	Yes	0.1	Yes

Figure 19: PM BSB NB Travel Time

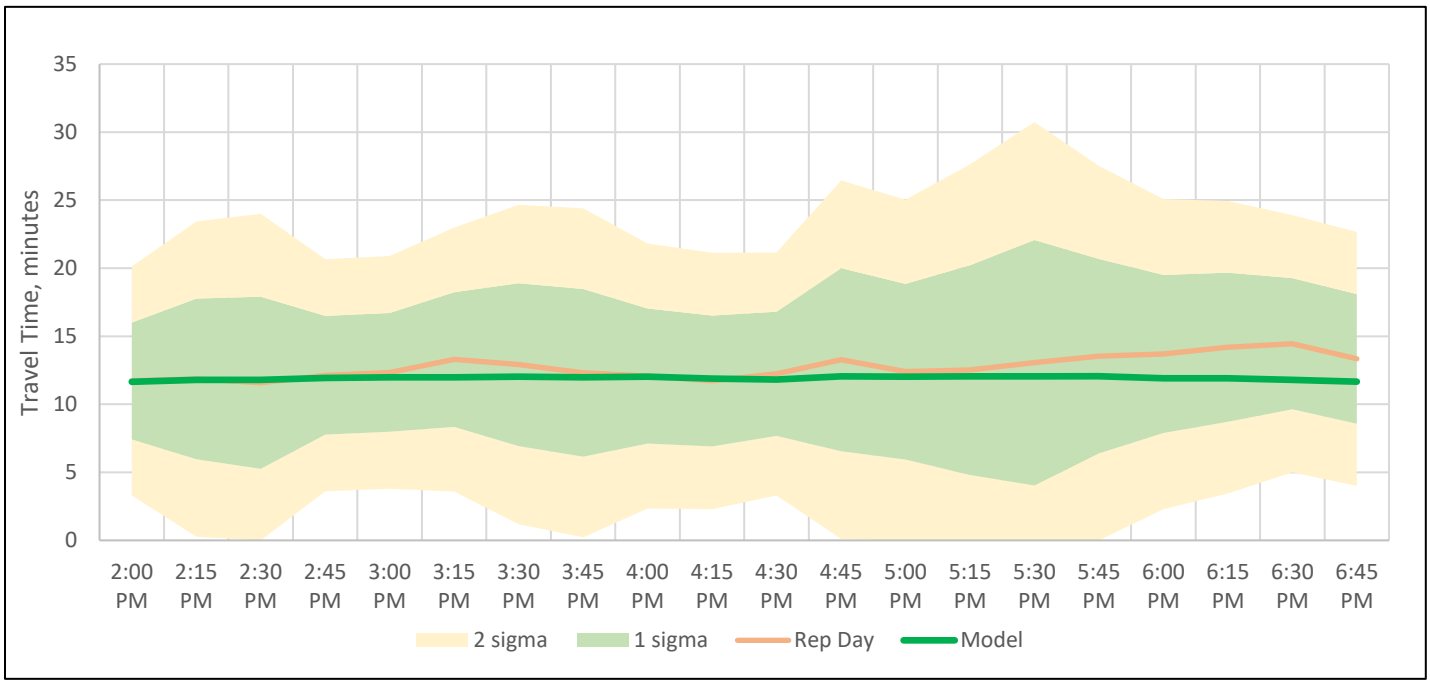
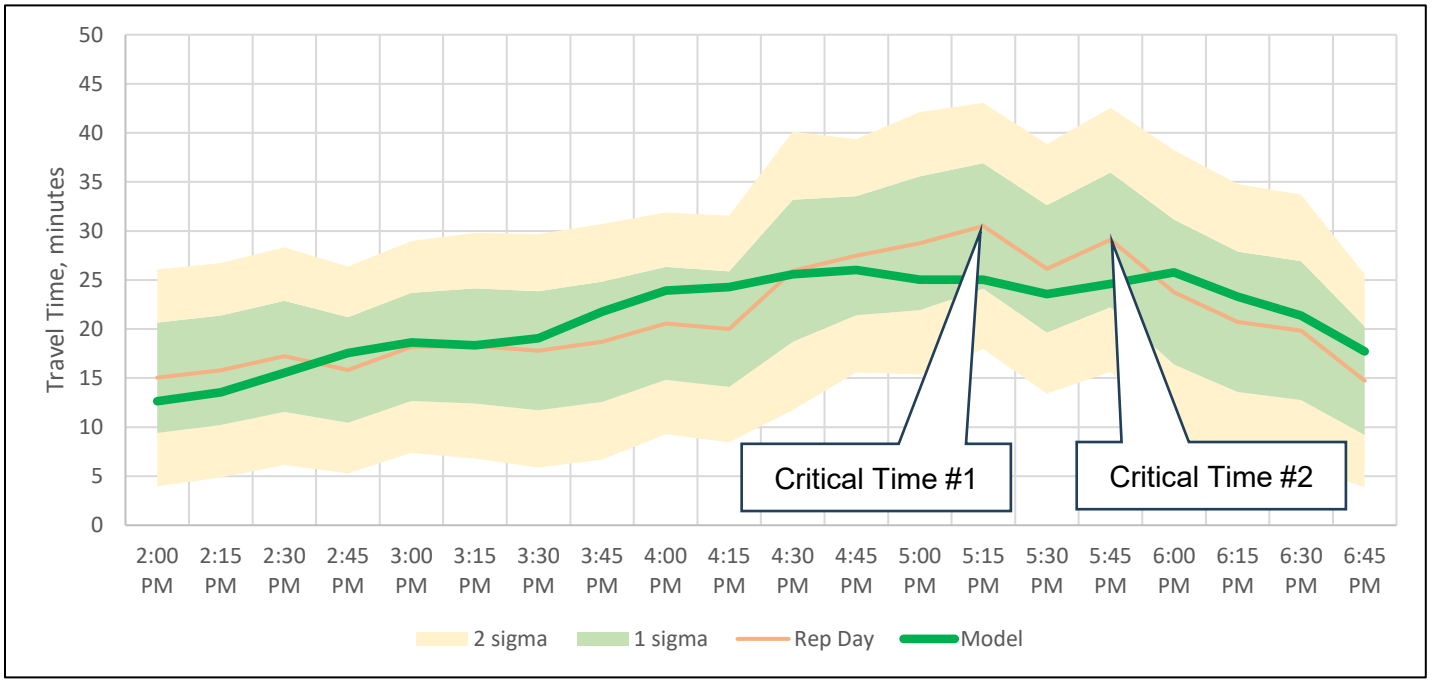


Figure 20: PM BSB SB Travel Time



5.6 PM Period Volume

The modeled volume throughput on the BSB was checked against the representative day. The volume calibration was achieved for all four criteria as shown in Table 6, Figure 21, and Figure 22.

Table 6: PM BSB Volume Throughput Calibration

Test	Description	Criteria	PM Model			
			NB I-71/75	Criteria Met?	SB I-71/75	Criteria Met?
Criteria I	95% within 2 Sigma	95% (or missing one target)	100%	Yes	95%	Yes
Criteria II	Two thirds within 1 Sigma	66.66%	94%	Yes	75%	Yes
	Critical Time Intervals within 1 Sigma	100%	100%	Yes	100%	Yes
Criteria III	BDAE	73/81 {15-min volume}	37	Yes	48	Yes
Criteria IV	One third BDAE	24/27 {15-min volume}	12	Yes	10	Yes

Figure 21: NB BSB Traffic Volume

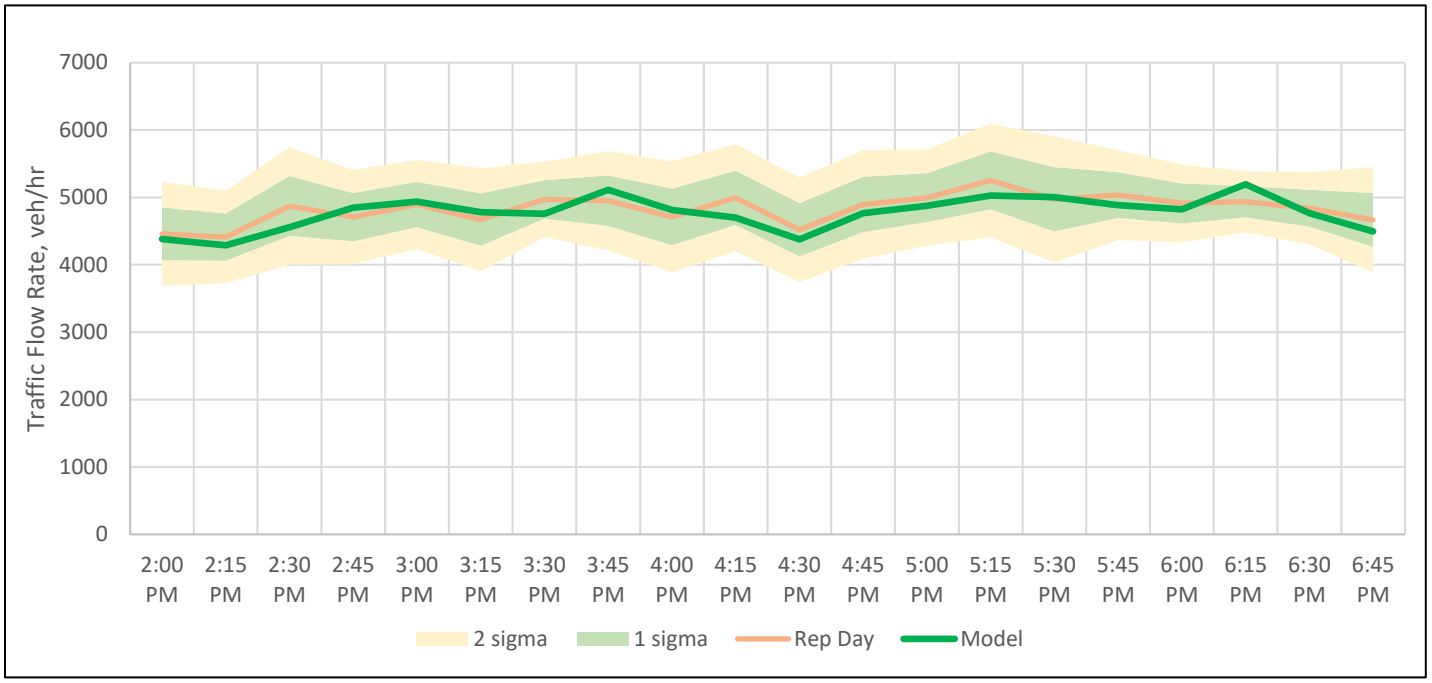
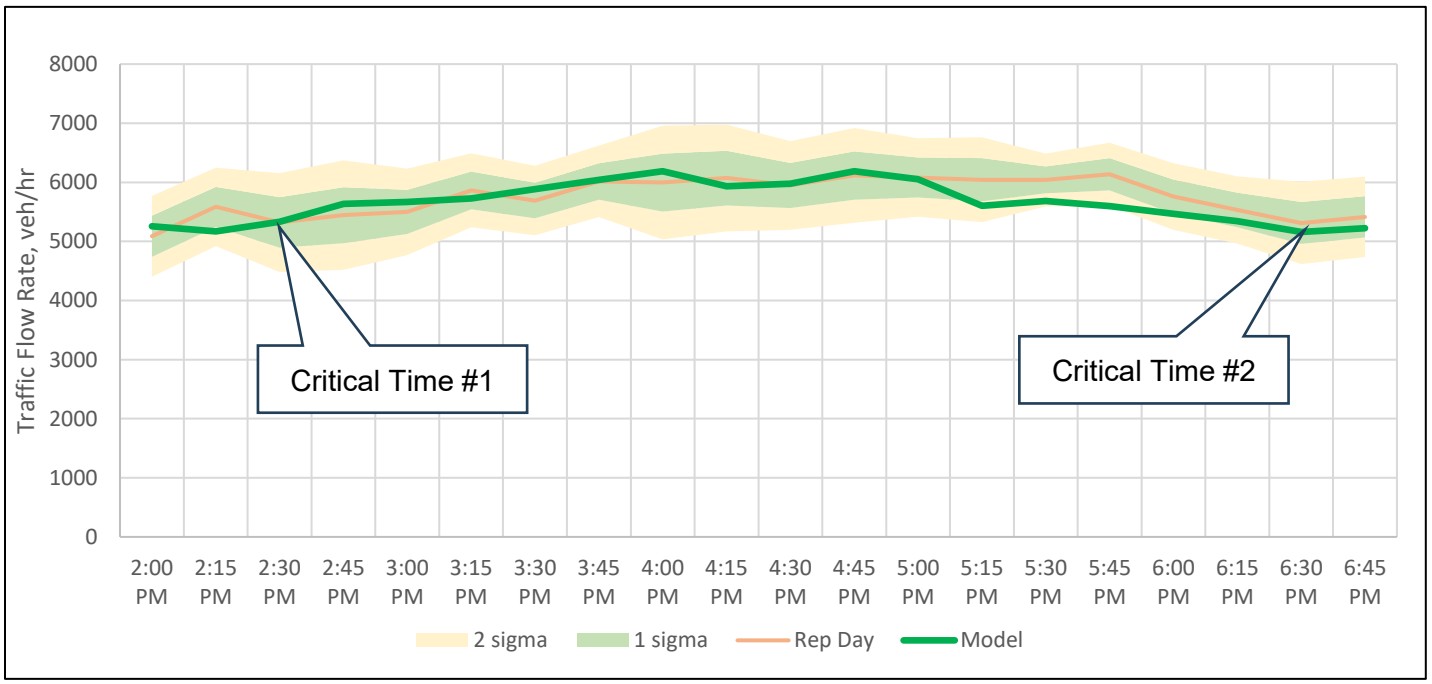


Figure 22: SB BSB Traffic Volume



6. DEVIATIONS FROM DEFAULT VALUES

The calibration workflow used for the value engineering models prioritized traffic demand adjustments to meet calibration targets. These adjustments included changes to the trip temporal distributions and refinements to the vehicle fleet inputs. Once the options for traffic adjustments were exhausted, the calibration was refined by modifying the normal acceleration, car following model, and headway buffers. As part of the TransModeler calibration for the IMS addendum, the traffic demand was adjusted as discussed in the Volume Development section. Additionally, calibration parameters were modified for NB and SB I-71/75 between Dixie Highway and BSB. All the calibration parameters modified from the default model parameters are discussed in the section below. This includes both parameters identified during the Value Engineering study and with the IMS addendum model updates.

6.1 Vehicle Fleet

The O-D matrices are divided into three classifications: Autos, SU Trucks, and Articulated Trucks. The characteristics of SU Trucks and Articulated Trucks are based on the default TransModeler definition. The Autos are more specifically defined based on vehicle fleet distributions. ODOT and KYTC have different default recommendations. These recommendations, as well as the fleet used in the BSB model, are detailed in Table 7. The BSB model fleet distribution uses project counts to determine the motorcycle, pickups/vans/SUV, and bus percentages. There are 125 project count locations with detailed vehicle classification data. These counts cover sites on the freeway mainline, freeway ramps, and arterial locations in Kentucky and Ohio. A summation of this count data is used to define the auto proportions. The remaining automobile distribution is divided between high, middle, and low performance vehicles. These characteristics are not part of the traffic count data, so the ODOT and KYTC relative proportions were averaged to allocate the remaining auto distributions. A comparison of the auto vehicle fleet information is summarized in Table 7.

Table 7: Auto Vehicle Fleet

Auto Vehicles Class	BSB Model	ODOT Default	KYTC Default
Motorcycles	0.3%	0.0%	0.0%
High Performance	14.6%	20.0%	5.5%
Middle Performance	39.6%	40.0%	21.9%
Low Performance	30.0%	30.0%	16.8%
Pickups/Vans/SUVs	14.9%	10.0%	55.3%
Buses	0.7%	0.0%	0.5%

6.2 Normal Acceleration

The KYTC TransModeler manual recommends modifications to the normal acceleration Beta parameter. The change in distribution for the Beta parameter results in slower accelerations for a portion of the modeled traffic. The TransModeler defaults and the parameters in the BSB model are shown in Table 8.

Table 8: Normal Acceleration

TransModeler Default		BSB Model (KYTC Recommendation)	
Percentage of Vehicles	Beta	Percentage of Vehicles	Beta
20	1.10	10	1.10
60	1.00	30	1.00
20	0.95	20	0.90
		20	0.88
		20	0.75

6.3 Car Following Model

The car following model is the Modified GM. The model coefficients are default except for the Alpha+ coefficient. The default is 1.81, and the calibrated model uses 2.31. This value is within the acceptable range outlined in the KYTC TransModeler manual, which states to calibrate the car following model by using Alpha values between 1.81 and 2.81. Increasing the alpha coefficient from 1.81 to 2.31 decreases roadway capacity. A range of values was tested during calibration of the Value Engineering models. 2.31 was chosen based on the volume throughput for SB I-71/75 at the BSB. The NB direction warranted further reduction in the capacity, which is accounted for using a local headway buffer parameter.

6.4 Headway Buffer

The headway buffer is identified in the OATS manual as a parameter to consider for adjustment during model calibration. This parameter can be applied locally or globally in the network. The headway buffer specifies the additional time drivers prefer between themselves and another vehicle. Increasing the buffer time decreases the roadway capacity. During the calibration workflow, the headway buffer was tested after modification to the normal acceleration and car following model. In the Value Engineering model, the headway buffer was applied only to NB I-71/75 between Buttermilk Parkway and the Ohio side of the Brent Spence Bridge. With the IMS addendum calibration update, a headway buffer is added to SB I-71/75 between 12th Street and Kyles Lane. The NB I-71/75 headway buffers are also adjusted to decrease the roadway capacity. Applying the parameters improves the convergence of the model for speeds, travel time, and volume throughput on the Brent Spence Bridge. A comparison of the default and proposed local headway buffers is summarized in Table 9. The two roadway segments with the local headway buffer calibration cover the project areas with the most severe grade changes.

Table 9: Headway Buffers

Percentage of Drivers	On Freeways (Sec)		
	Default	NB I-71/75 (Buttermilk to BSB)	SB I-71/75 (12th Street to Kyles Lane)
10	0.00	0.04	0.05
10	0.02	0.08	0.10
10	0.03	0.17	0.18
10	0.04	0.22	0.24
10	0.05	0.28	0.30
10	0.06	0.33	0.36
10	0.07	0.39	0.42
10	0.07	0.44	0.48
10	0.09	0.50	0.54
10	0.10	0.55	0.60

6.5 Lane Restrictions

SB I-71/75 in Kentucky between the BSB and Kyles Lane is signed with truck restrictions for the two left lanes. The value engineering models used these truck restrictions with a default compliance rate of 100%. This input was reviewed with the calibration update by reviewing traffic count data for two count sites on I-71/I-75 (059072 & 059P93), within the lane restricted area. The count data indicates an 85% compliance rate for truck classes 6 to 13 during the PM peak period. During off-peak periods, the truck compliance is slightly better, with observed compliance near 90%. The model compliance rate for the truck restricted lanes is set to 85% and is a deviation from the TransModeler default of 100% compliance.

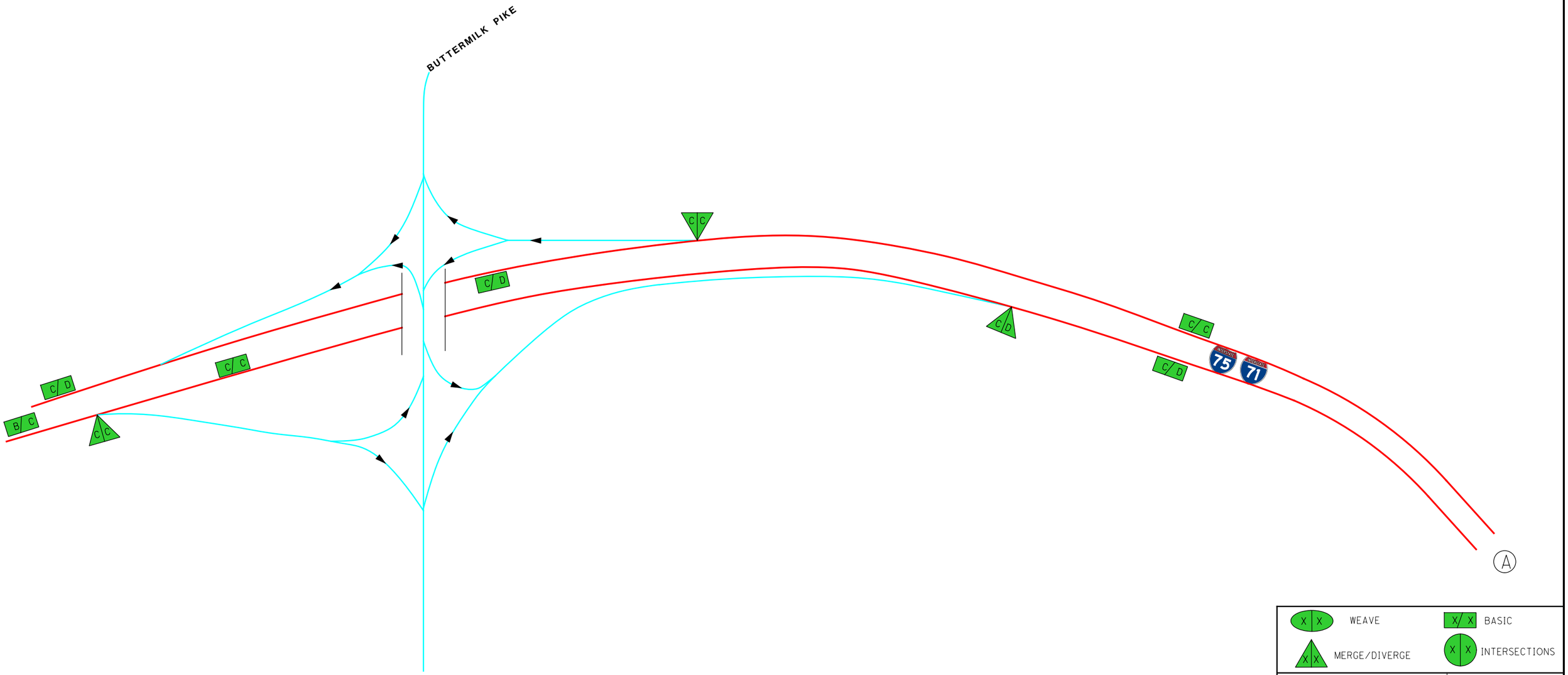
7. CONCLUSION

The Existing 2019 TransModeler models for the AM and PM periods are modified from the Value Engineering study in 2022 to achieve an updated calibration methodology agreed upon by all stakeholders. The calibration parameters outlined in this report will be carried over to the 2049 Build Alternative I and Alternative I-W models. These future models will maintain the 4-hour AM and 5-hour PM periods, with the three vehicle classifications used for the Existing models.

Appendix B:
2049 Refined Alternative I (Concept I-W) Level of Service

NOTE

BUTTERMILK PIKE DIVERGING DIAMOND INTERCHANGE IS THE PREFERRED ALTERNATIVE FOR THE I-71/I-75 & I-275 INTERCHANGE PROJECT. THE INTERCHANGE WILL NOT BE CONSTRUCTED AS PART OF THE BRENT SPENCE BRIDGE CORRIDOR PROJECT.



X X WEAVE	X/X BASIC
X X MERGE/DIVERGE	X X INTERSECTIONS
I-71	VOLUMES: AM/PM
I-75	LOS: AM/PM
COLLECTOR-DISTRIBUTOR	LOS A-D
US 50	LOS E
LOCAL ROADS AND RAMPS	LOS F

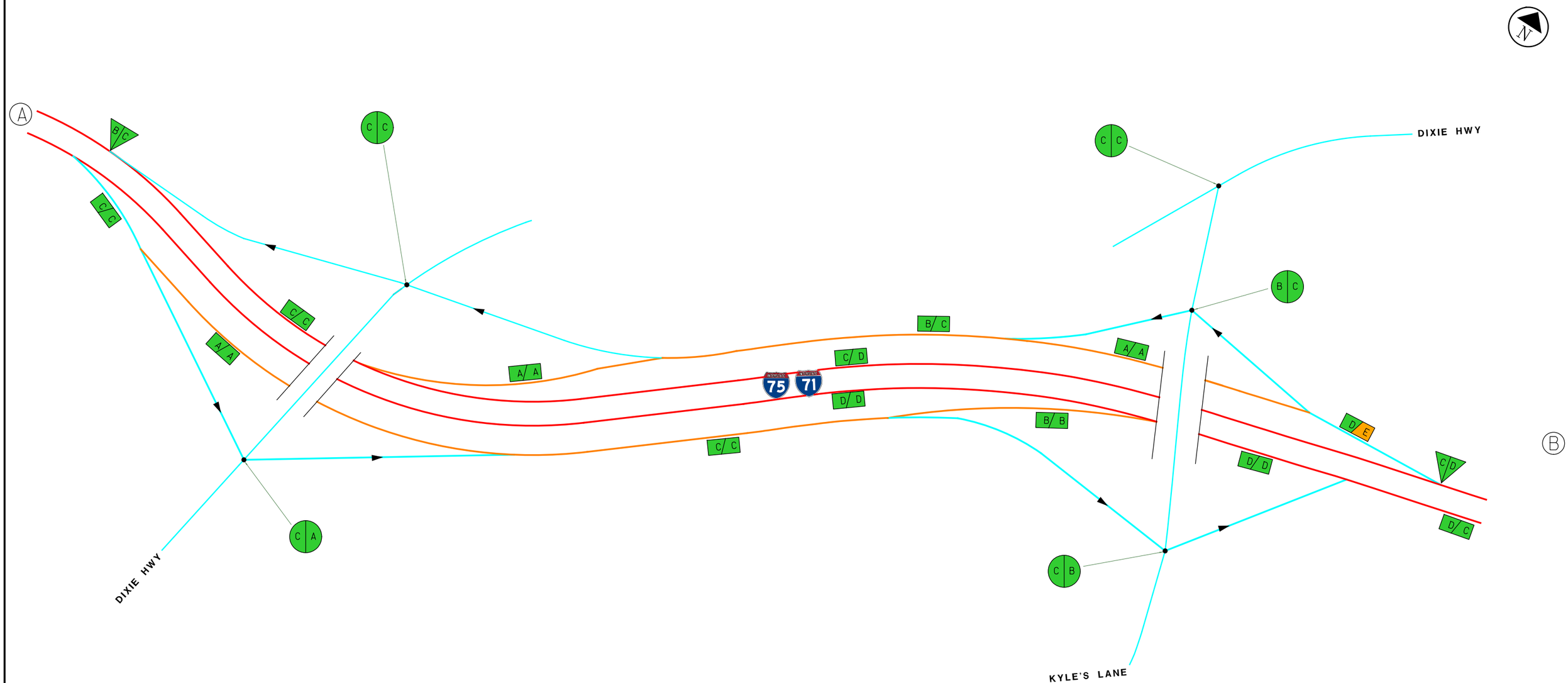
BRENT SPENCE BRIDGE

TRANSMODELER LEVEL OF SERVICE

PLATE 1 OF 9 (KY) | REFINED ALTERNATIVE I (CONCEPT I-W)

DECEMBER 2023 | NOT TO SCALE

HNTB



X X WEAVE

X/ X BASIC

X X MERGE/DIVERGE

X X INTERSECTIONS

I-71

I-75

COLLECTOR-DISTRIBUTOR

US 50

LOCAL ROADS AND RAMPS

VOLUMES: AM/PM

LOS: AM/PM

LOS A-D

LOS E

LOS F

BRENT SPENCE BRIDGE

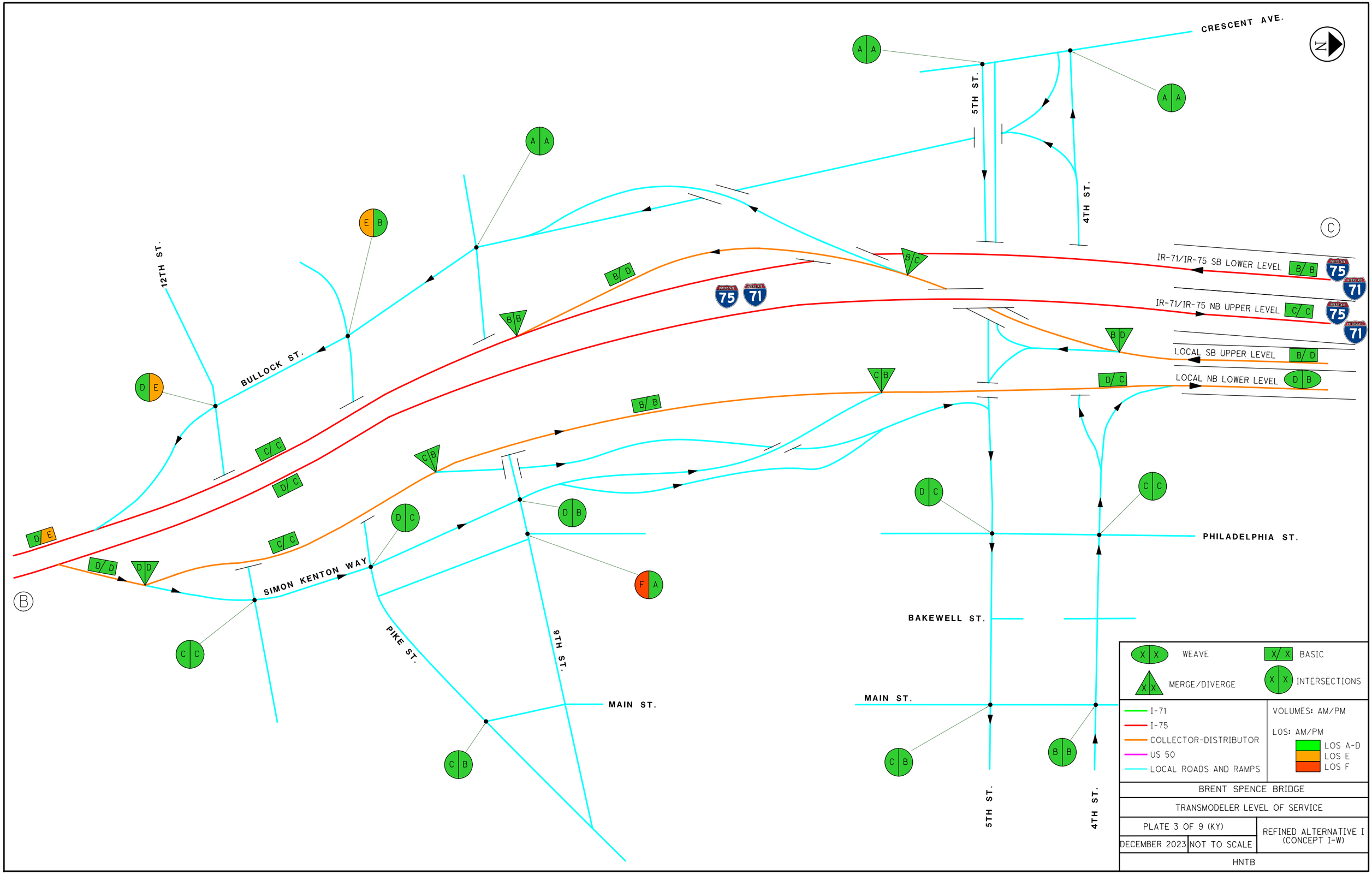
TRANSMODELER LEVEL OF SERVICE

PLATE 2 OF 9 (KY)

DECEMBER 2023 | NOT TO SCALE

REFINED ALTERNATIVE I (CONCEPT I-W)

HNTB



BRENT SPENCE BRIDGE

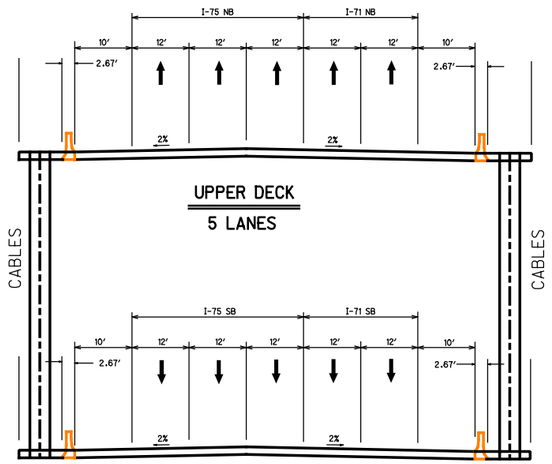
TRANSMODELER LEVEL OF SERVICE

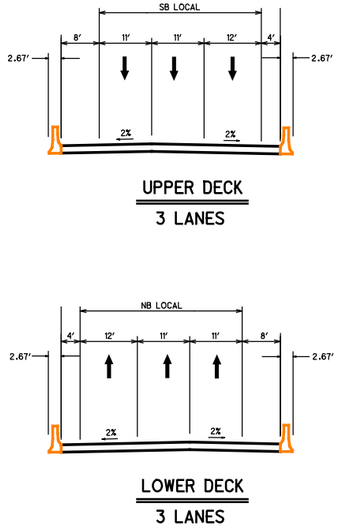
PLATE 3 OF 9 (KY)

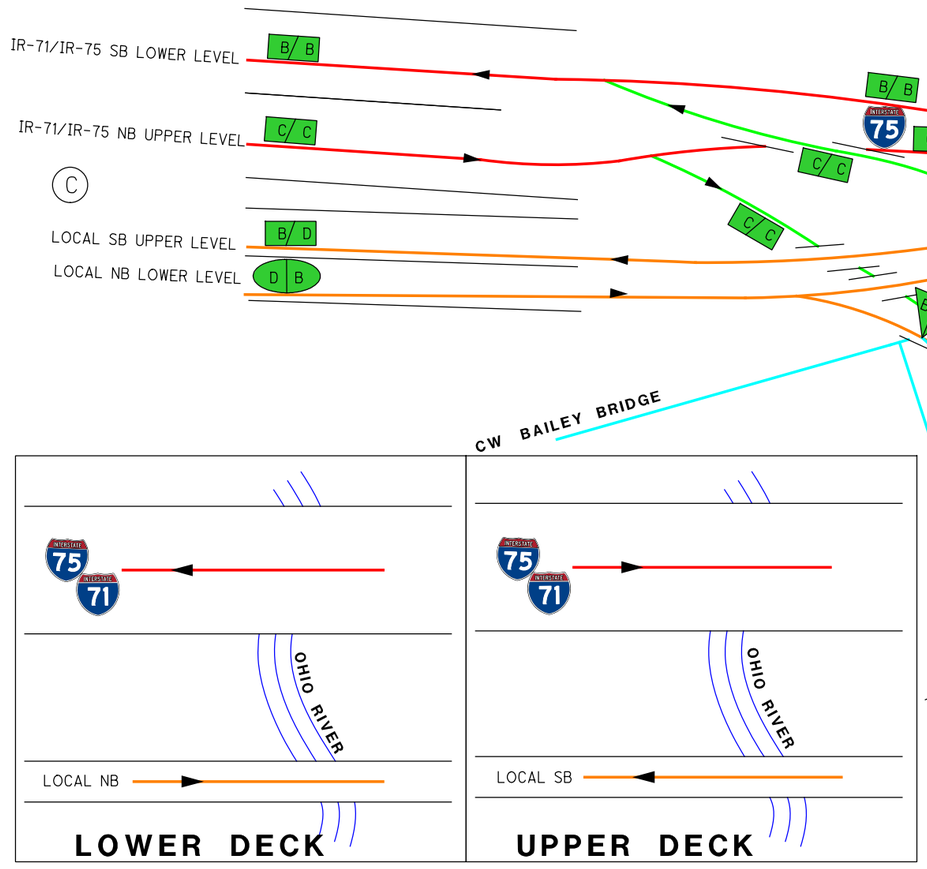
REFINED ALTERNATIVE I (CONCEPT I-W)

DECEMBER 2023 | NOT TO SCALE

HNTB







WEAVE
BASIC
MERGE/DIVERGE
INTERSECTIONS

I-71
I-75
COLLECTOR-DISTRIBUTOR
US 50
LOCAL ROADS AND RAMPS

VOLUMES: AM/PM

LOS: AM/PM
LOS A-D
LOS E
LOS F

BRENT SPENCE BRIDGE

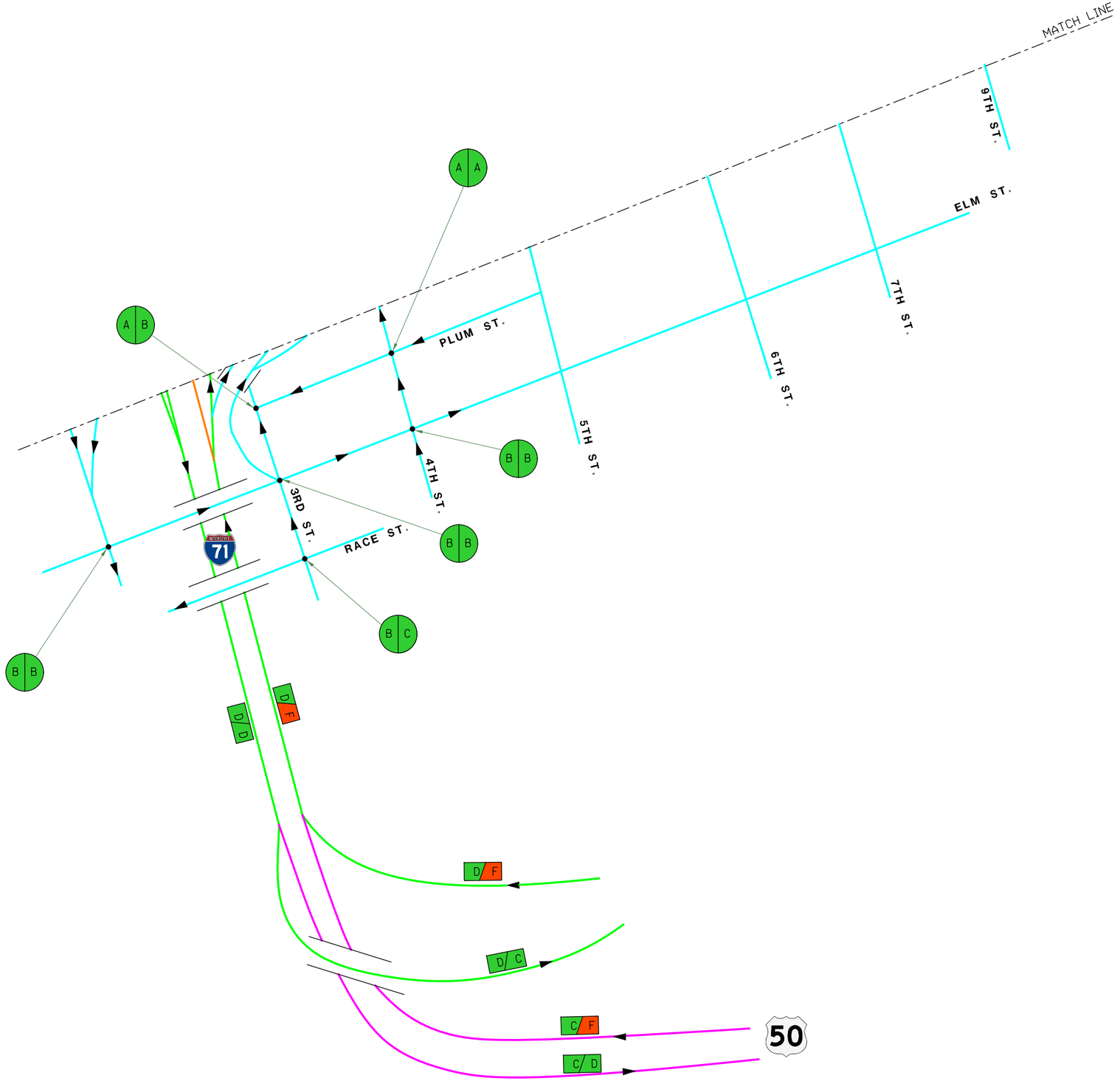
TRANSMODELER LEVEL OF SERVICE

PLATE 4 OF 9 (OH)

DECEMBER 2023 | NOT TO SCALE

REFINED ALTERNATIVE I (CONCEPT I-W)

HNTB



X X WEAVE

X X BASIC

X X MERGE/DIVERGE

X X INTERSECTIONS

I-71
I-75
COLLECTOR-DISTRIBUTOR
US 50
LOCAL ROADS AND RAMPS

VOLUMES: AM/PM

LOS: AM/PM

LOS A-D
LOS E
LOS F

BRENT SPENCE BRIDGE

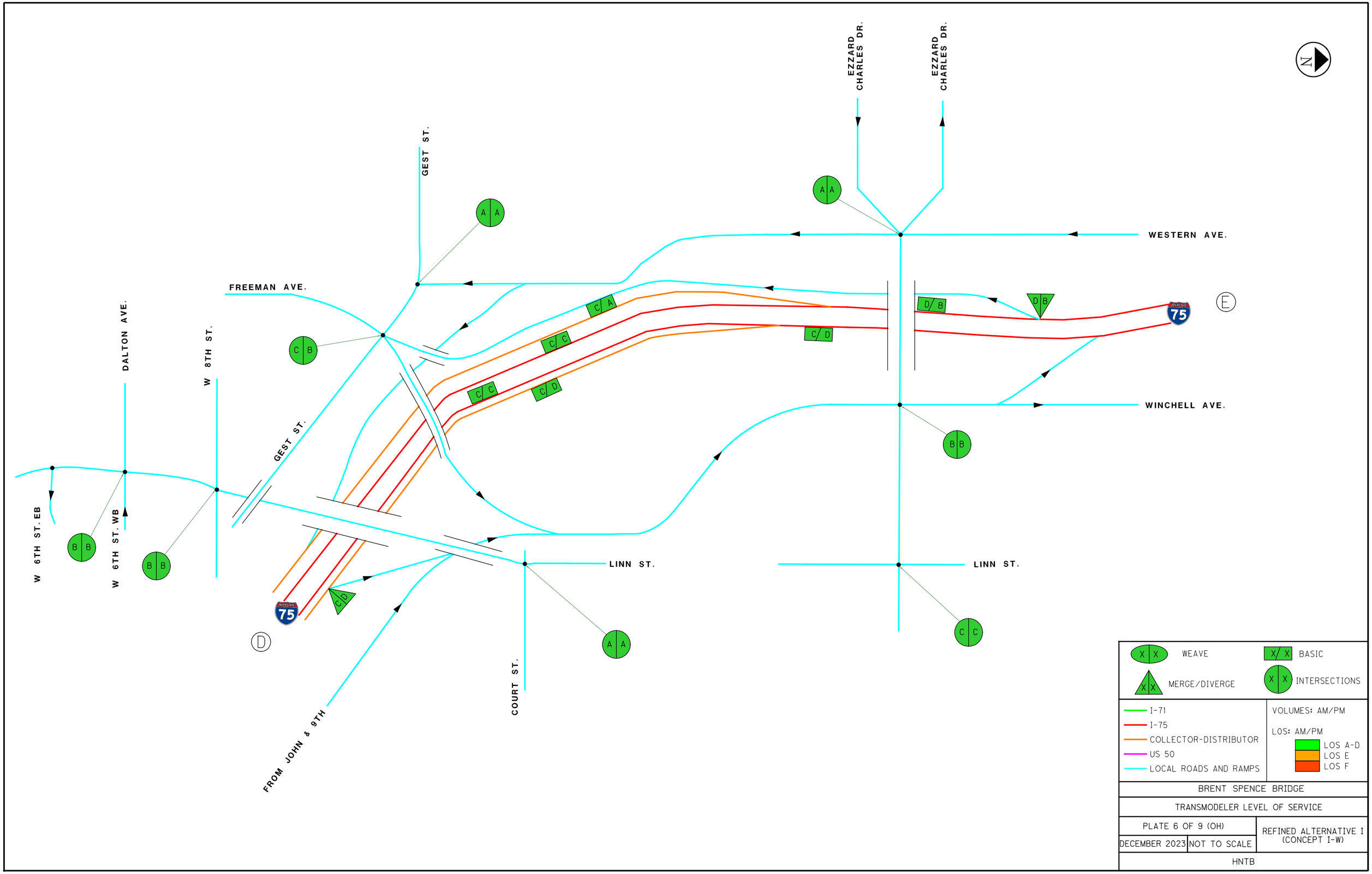
TRANSMODELER LEVEL OF SERVICE

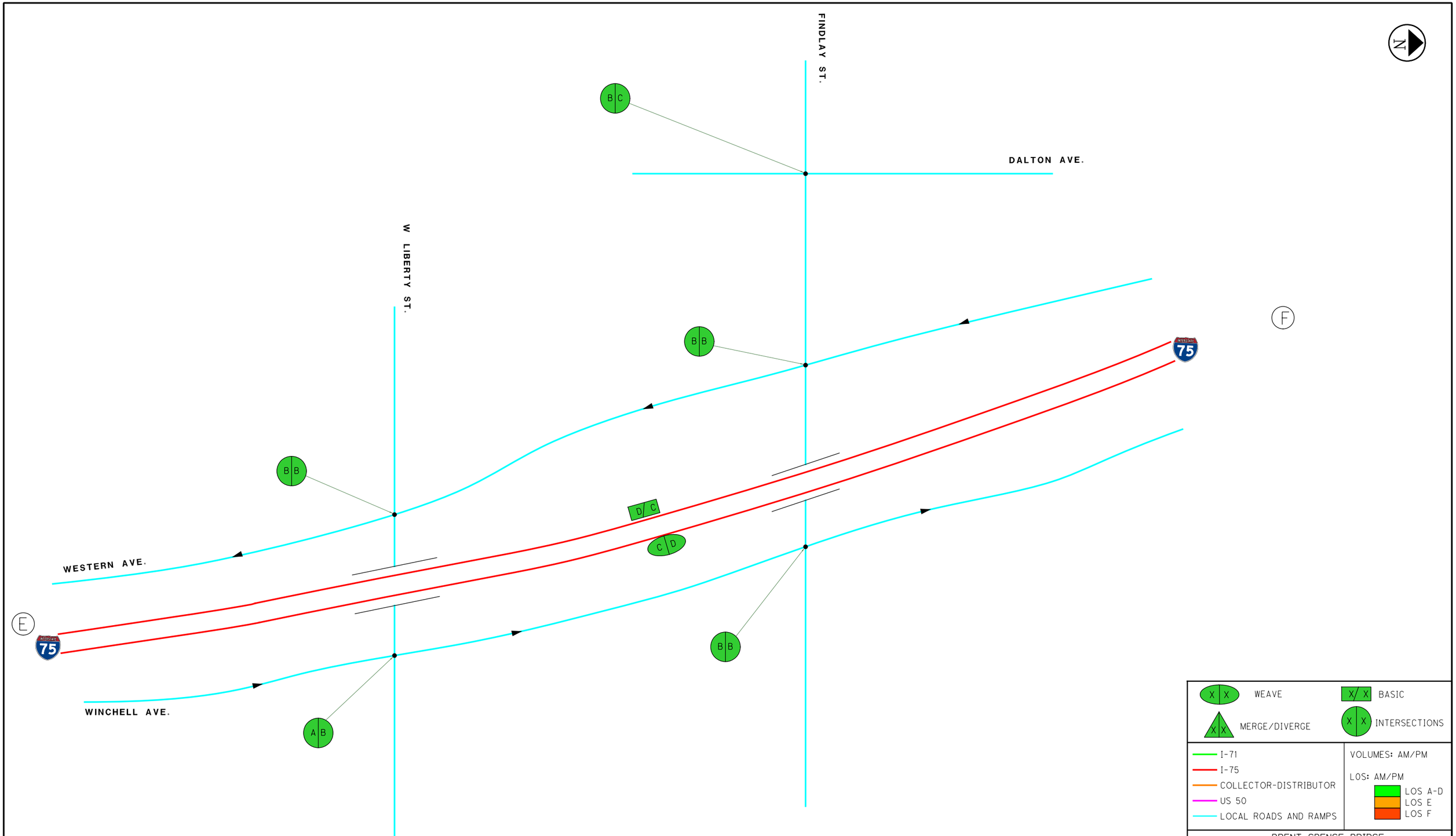
PLATE 5 OF 9 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W)

DECEMBER 2023 | NOT TO SCALE

HNTB


EZZARD CHARLES DR.
EZZARD CHARLES DR.
GEST ST.
WESTERN AVE.
FREEMAN AVE.
DALTON AVE.
W 8TH ST.
GEST ST.
WINCHELL AVE.
W 6TH ST. EB
W 6TH ST. WB
LINN ST.
LINN ST.
COURT ST.
FROM JOHN & 9TH
E
D
WEAVE
BASIC
MERGE/DIVERGE
INTERSECTIONS
I-71
I-75
COLLECTOR-DISTRIBUTOR
US 50
LOCAL ROADS AND RAMPS
VOLUMES: AM/PM
LOS: AM/PM
LOS A-D
LOS E
LOS F
BRENT SPENCE BRIDGE
TRANSMODELER LEVEL OF SERVICE
PLATE 6 OF 9 (OH)
REFINED ALTERNATIVE I (CONCEPT I-W)
DECEMBER 2023
NOT TO SCALE
HNTB



X X WEAVE
X/ X BASIC
X X MERGE/DIVERGE
X X INTERSECTIONS

I-71
I-75
COLLECTOR-DISTRIBUTOR
US 50
LOCAL ROADS AND RAMPS

VOLUMES: AM/PM

LOS: AM/PM
LOS A-D
LOS E
LOS F

BRENT SPENCE BRIDGE

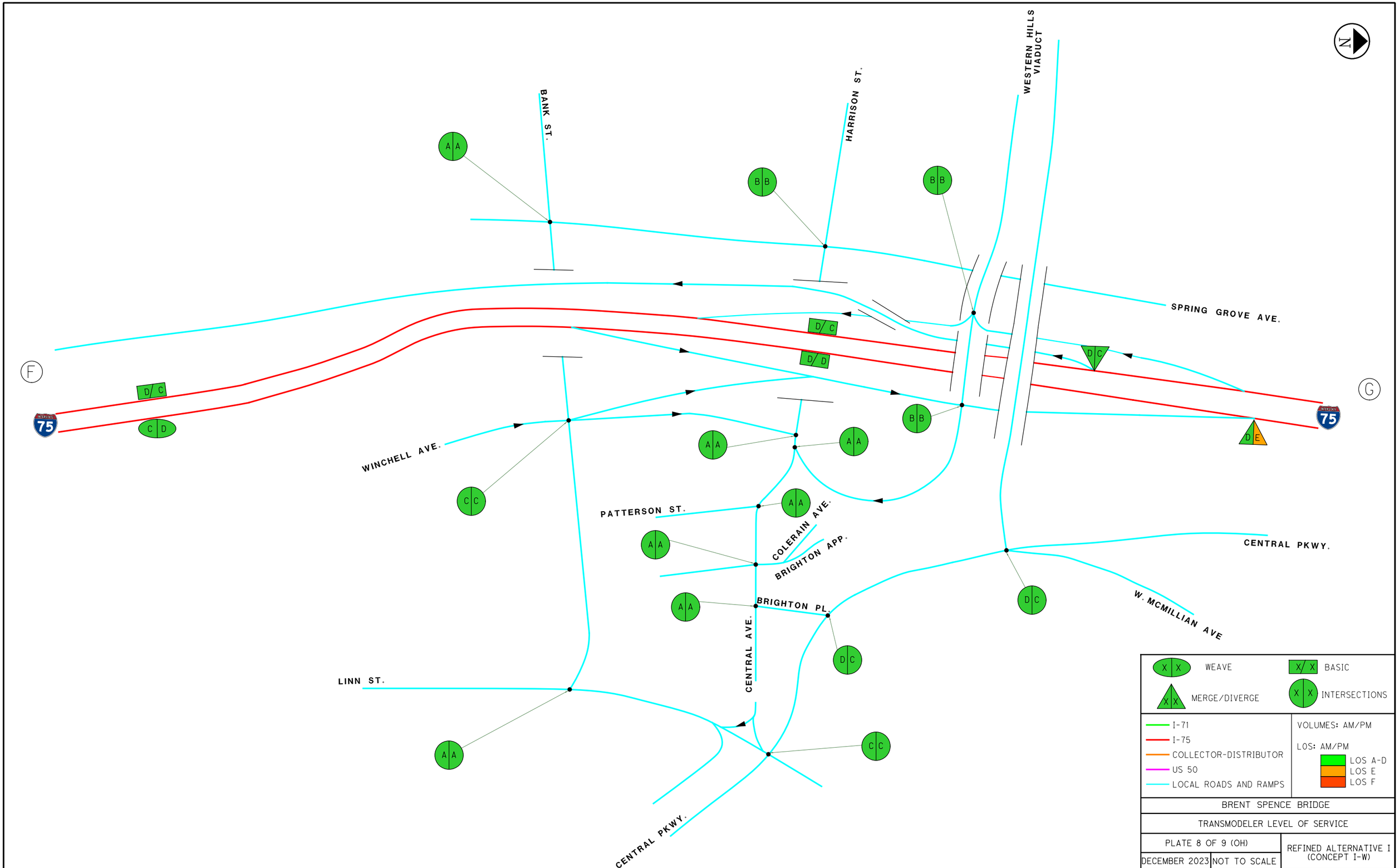
TRANSMODELER LEVEL OF SERVICE

PLATE 7 OF 9 (OH)

REFINED ALTERNATIVE I (CONCEPT I-W)

DECEMBER 2023 | NOT TO SCALE

HNTB


N
WESTERN HILLS VIADUCT
HARRISON ST.
BANK ST.
SPRING GROVE AVE.
F
G
I-75
I-75
WINCHELL AVE.
PATTERSON ST.
COLERAIN AVE.
BRIGHTON APP.
CENTRAL PKWY.
BRIGHTON PL.
CENTRAL AVE.
W. MCMILLIAN AVE
LINN ST.
CENTRAL PKWY.
A A
B B
B B
D C
D D
D C
C D
A A
A A
B B
D E
C C
A A
A A
D C
A A
D C
C C
WEAVE
BASIC
MERGE/DIVERGE
INTERSECTIONS
I-71
I-75
COLLECTOR-DISTRIBUTOR
US 50
LOCAL ROADS AND RAMPS
VOLUMES: AM/PM
LOS: AM/PM
LOS A-D
LOS E
LOS F
BRENT SPENCE BRIDGE
TRANSMODELER LEVEL OF SERVICE
PLATE 8 OF 9 (OH)
REFINED ALTERNATIVE I (CONCEPT I-W)
DECEMBER 2023
NOT TO SCALE
HNTB

N

G

HOPPLE ST

CENTRAL PKWY.

MARTIN LUTHER KING DR

I-75

C C

D D

D D

D C

C D

D E

X X WEAVE	X X BASIC
X X MERGE/DIVERGE	X X INTERSECTIONS
I-71	VOLUMES: AM/PM
I-75	LOS: AM/PM
COLLECTOR-DISTRIBUTOR	LOS A-D
US 50	LOS E
LOCAL ROADS AND RAMPS	LOS F

BRENT SPENCE BRIDGE

TRANSMODELER LEVEL OF SERVICE

PLATE 9 OF 9 (OH) | REFINED ALTERNATIVE I (CONCEPT I-W)

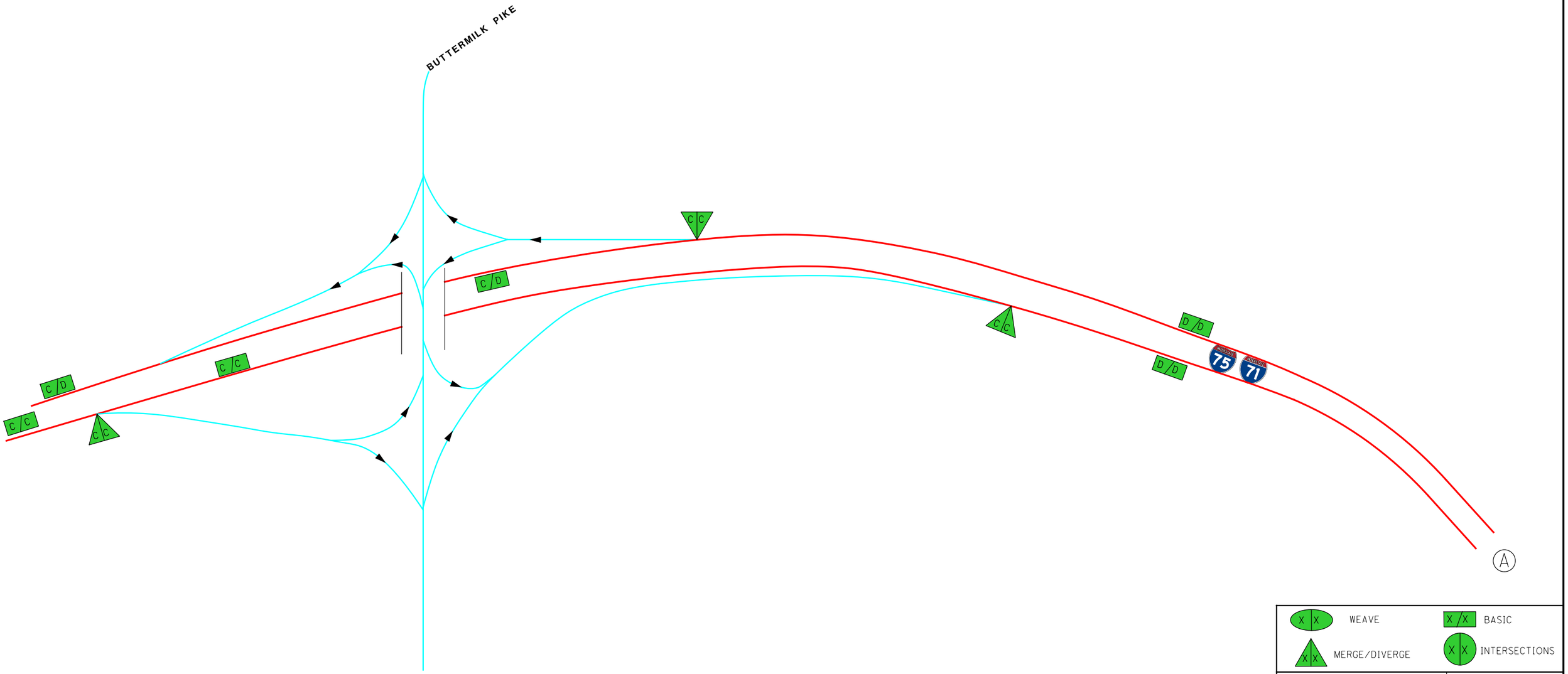
DECEMBER 2023 | NOT TO SCALE

HNTB

Appendix C:
2049 Build Innovations Level of Service

NOTE

BUTTERMILK PIKE DIVERGING DIAMOND INTERCHANGE IS THE PREFERRED ALTERNATIVE FOR THE I-71/I-75 & I-275 INTERCHANGE PROJECT. THE INTERCHANGE WILL NOT BE CONSTRUCTED AS PART OF THE BRENT SPENCE BRIDGE CORRIDOR PROJECT.



X/X WEAVE	X/X BASIC
X/X MERGE/DIVERGE	X/X INTERSECTIONS
I-71/I-75	LOS: AM/PM
COLLECTOR-DISTRIBUTOR	LOS A-D
US 50	LOS E
LOCAL ROADS AND RAMPS	LOS F

BRENT SPENCE BRIDGE

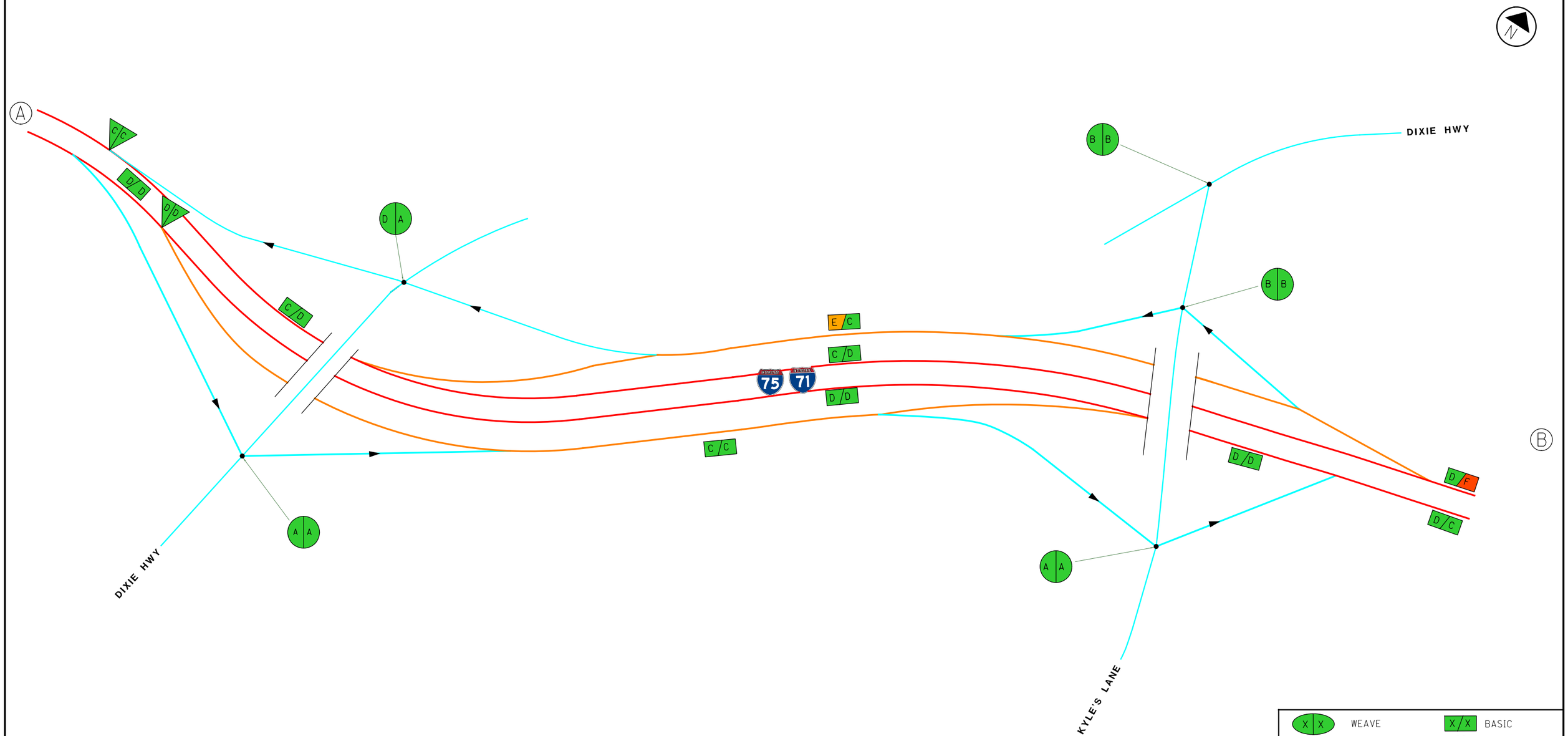
TRANSMODELER LEVEL OF SERVICE

PLATE 1 OF 10 (KY)

JUNE 2025 | NOT TO SCALE

BUILD INNOVATIONS

HNTB



BRENT SPENCE BRIDGE

TRANSMODELER LEVEL OF SERVICE

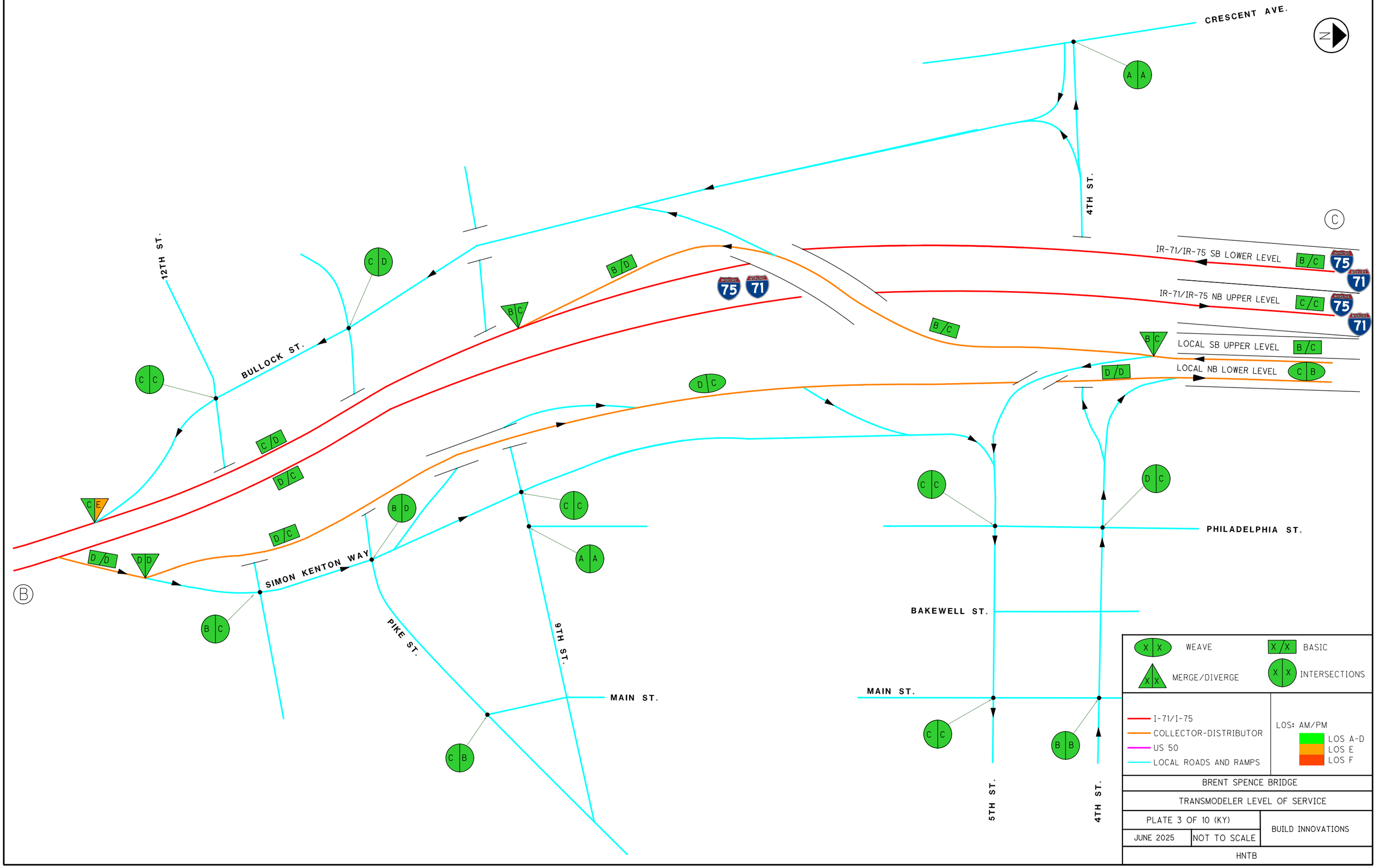
PLATE 2 OF 10 (KY)

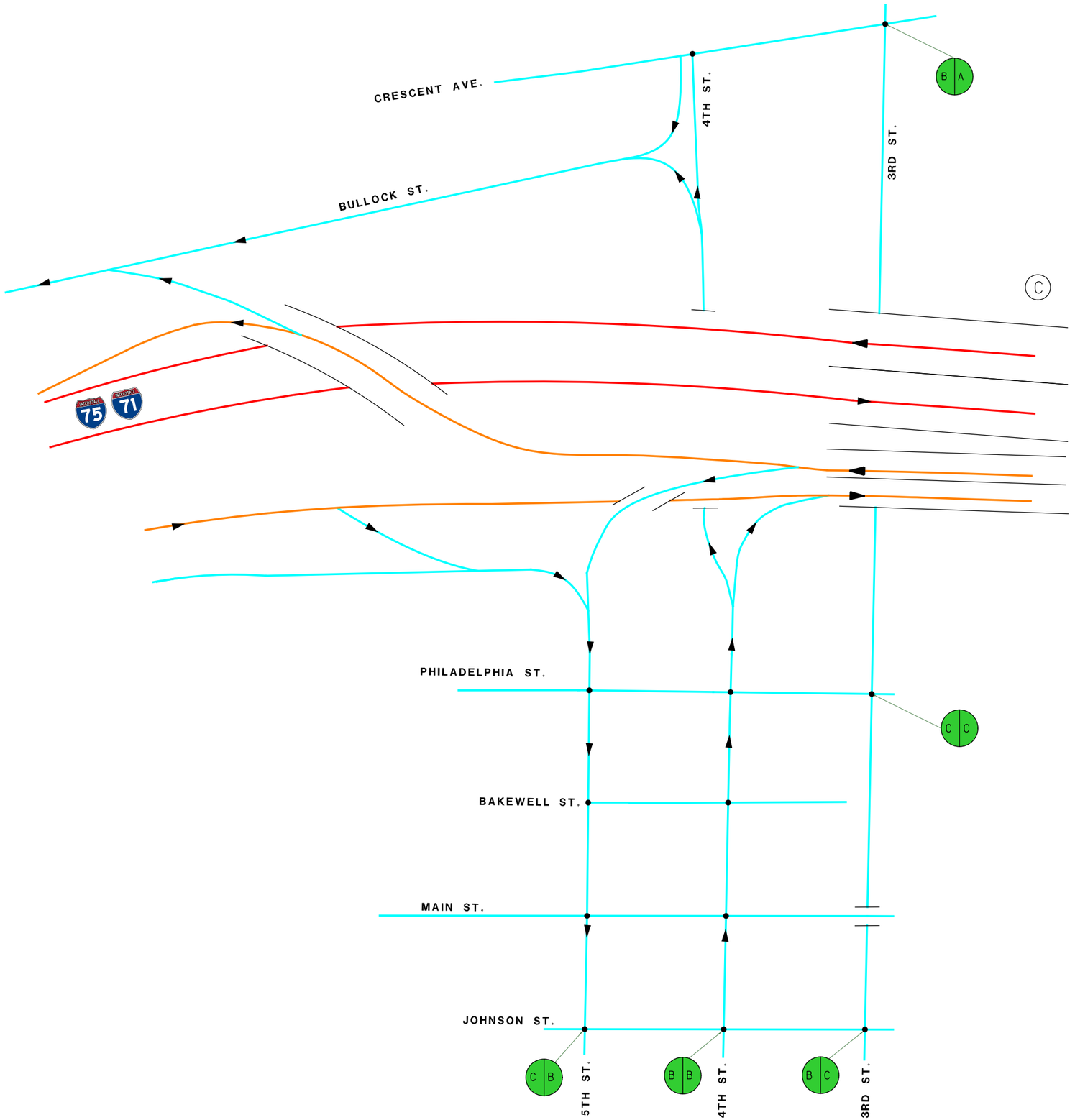
BUILD INNOVATIONS

JUNE 2025

NOT TO SCALE

HNTB


CRESCENT AVE.
4TH ST.
12TH ST.
BULLOCK ST.
SIMON KENTON WAY
PIKE ST.
9TH ST.
MAIN ST.
PHILADELPHIA ST.
BAKEWELL ST.
MAIN ST.
5TH ST.
4TH ST.
IR-71/IR-75 SB LOWER LEVEL
IR-71/IR-75 NB UPPER LEVEL
LOCAL SB UPPER LEVEL
LOCAL NB LOWER LEVEL
A A
B C
B D
C D
C C
D C
C E
D D
B B
C B
WEAVE
BASIC
MERGE/DIVERGE
INTERSECTIONS
I-71/I-75
COLLECTOR-DISTRIBUTOR
US 50
LOCAL ROADS AND RAMPS
LOS: AM/PM
LOS A-D
LOS E
LOS F
BRENT SPENCE BRIDGE
TRANSMODELER LEVEL OF SERVICE
PLATE 3 OF 10 (KY)
JUNE 2025
NOT TO SCALE
BUILD INNOVATIONS
HNTB



SEE PLATE 3 FOR
ADDITIONAL VALUES

X X WEAVE
X/X BASIC
X X MERGE/DIVERGE
X X INTERSECTIONS

I-71/I-75
COLLECTOR-DISTRIBUTOR
US 50
LOCAL ROADS AND RAMPS

LOS: AM/PM
LOS A-D
LOS E
LOS F

BRENT SPENCE BRIDGE

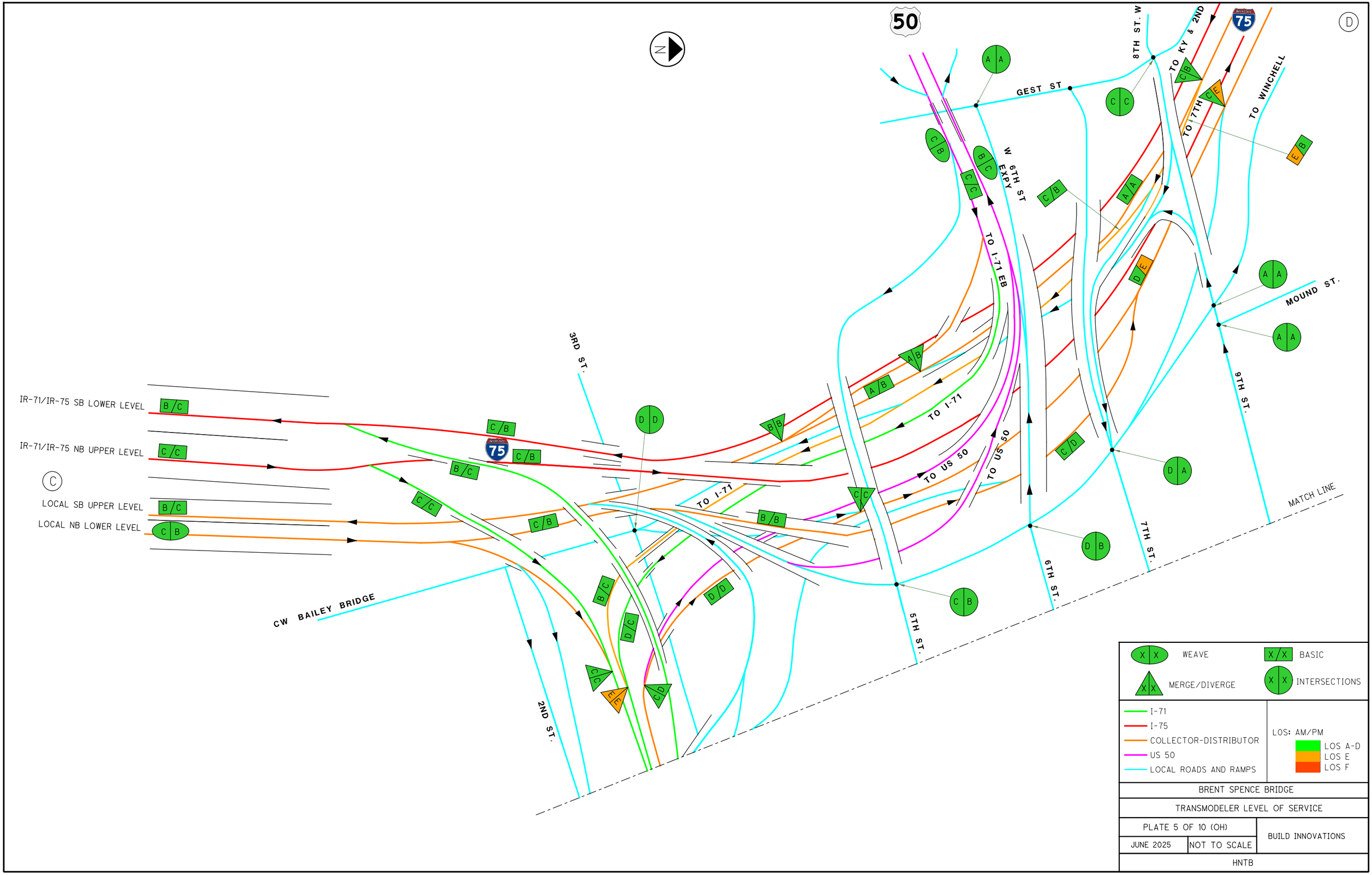
TRANSMODELER LEVEL OF SERVICE

PLATE 4 OF 10 (KY)

JUNE 2025 | NOT TO SCALE

BUILD INNOVATIONS

HNTB



BRENT SPENCE BRIDGE

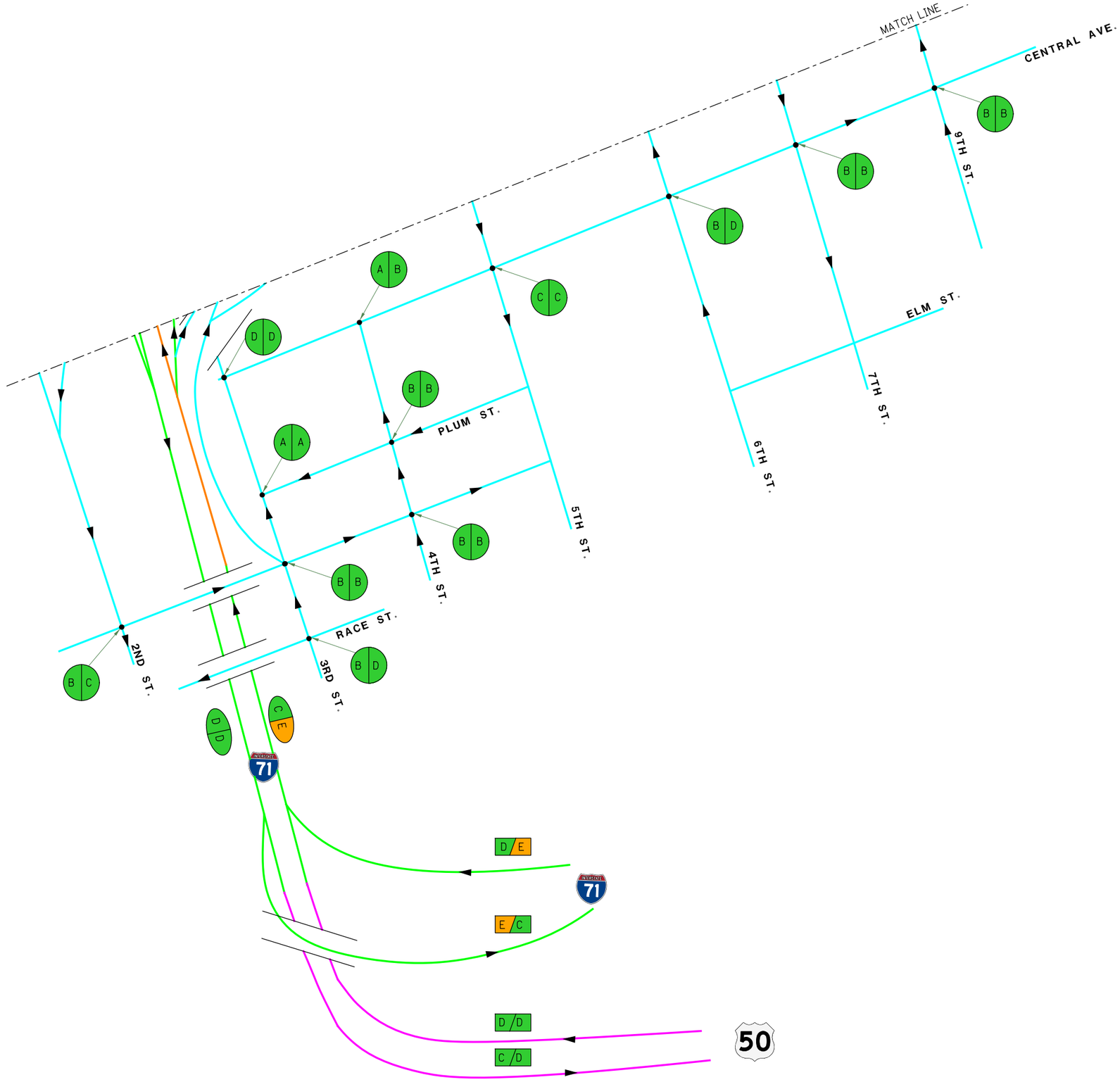
TRANSMODELER LEVEL OF SERVICE

PLATE 5 OF 10 (OH)

JUNE 2025 | NOT TO SCALE

BUILD INNOVATIONS

HNTB



N

X X WEAVE

X / X BASIC

X X MERGE/DIVERGE

X X INTERSECTIONS

I-71

COLLECTOR-DISTRIBUTOR

US 50

LOCAL ROADS AND RAMPS

LOS: AM/PM

LOS A-D

LOS E

LOS F

BRENT SPENCE BRIDGE

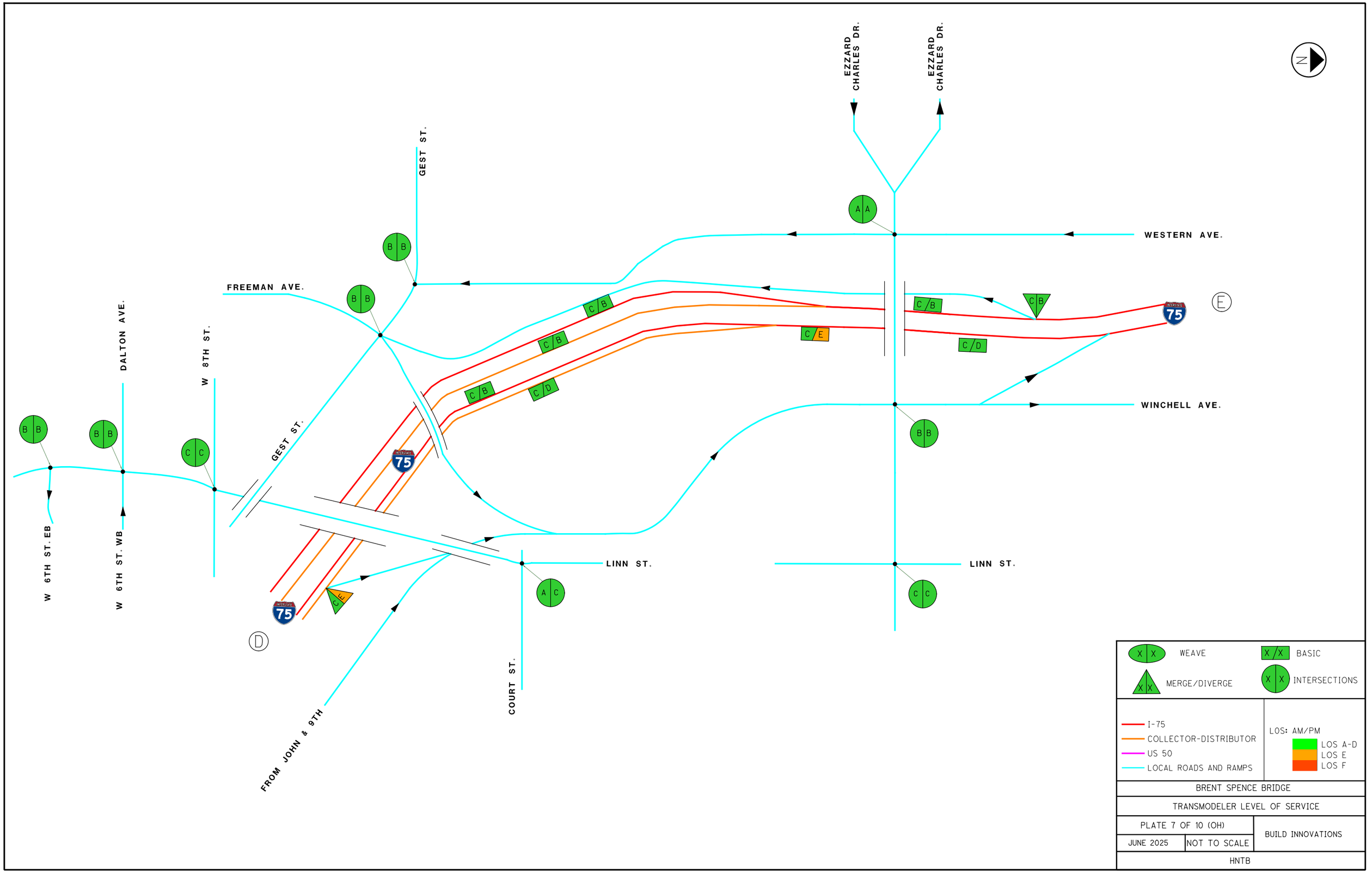
TRANSMODELER LEVEL OF SERVICE

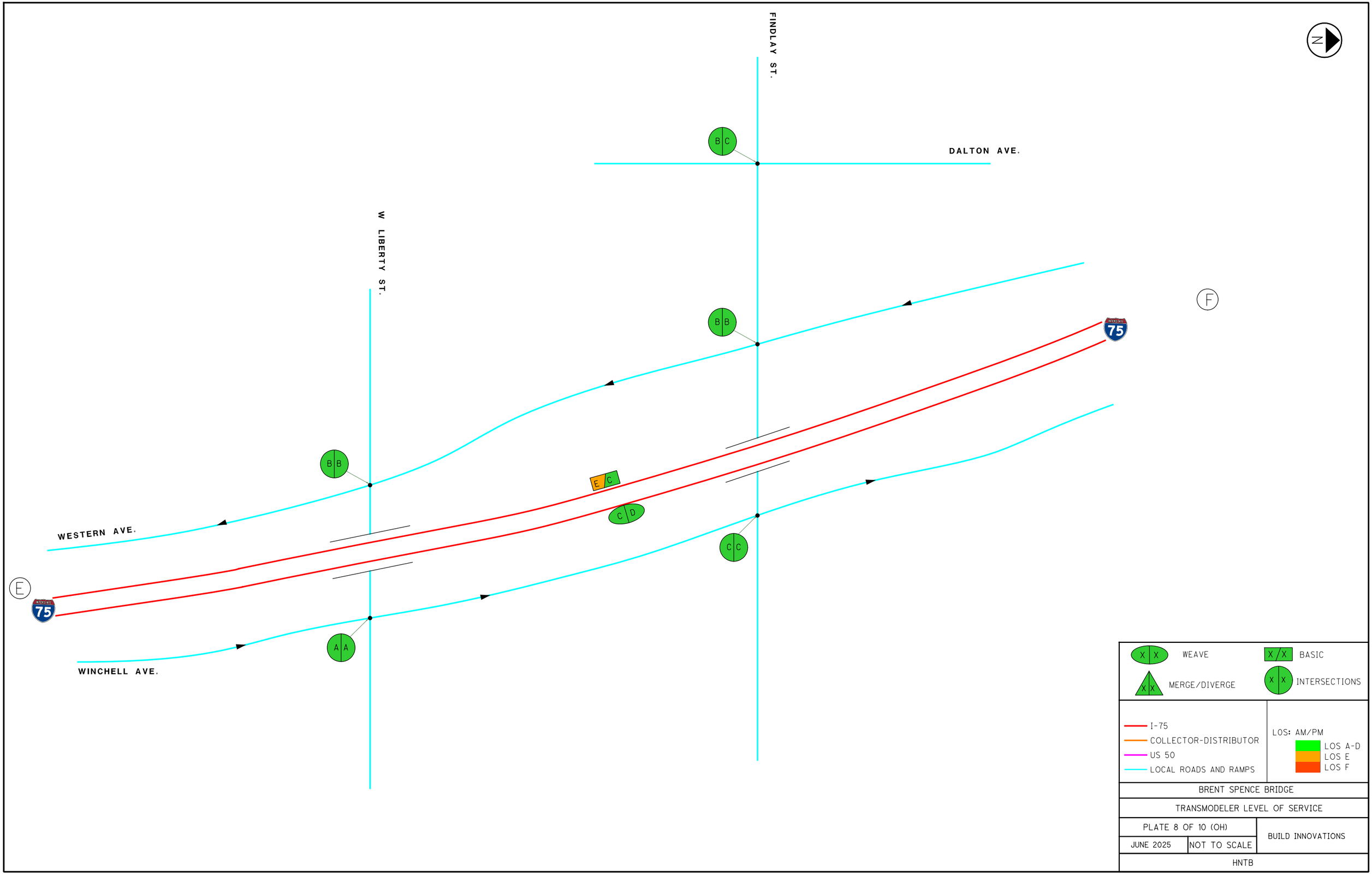
PLATE 6 OF 10 (OH)

JUNE 2025 | NOT TO SCALE

BUILD INNOVATIONS

HNTB


EZZARD CHARLES DR.
EZZARD CHARLES DR.
GEST ST.
WESTERN AVE.
FREEMAN AVE.
DALTON AVE.
W 8TH ST.
WINCHELL AVE.
GEST ST.
W 6TH ST. EB
W 6TH ST. WB
LINN ST.
LINN ST.
COURT ST.
FROM JOHN & 9TH
E
D
WEAVE
BASIC
MERGE/DIVERGE
INTERSECTIONS
I-75
COLLECTOR-DISTRIBUTOR
US 50
LOCAL ROADS AND RAMPS
LOS: AM/PM
LOS A-D
LOS E
LOS F
BRENT SPENCE BRIDGE
TRANSMODELER LEVEL OF SERVICE
PLATE 7 OF 10 (OH)
BUILD INNOVATIONS
JUNE 2025
NOT TO SCALE
HNTB



X X WEAVE
X/X BASIC
X X MERGE/DIVERGE
X X INTERSECTIONS

I-75
COLLECTOR-DISTRIBUTOR
US 50
LOCAL ROADS AND RAMPS

LOS: AM/PM
LOS A-D
LOS E
LOS F

BRENT SPENCE BRIDGE

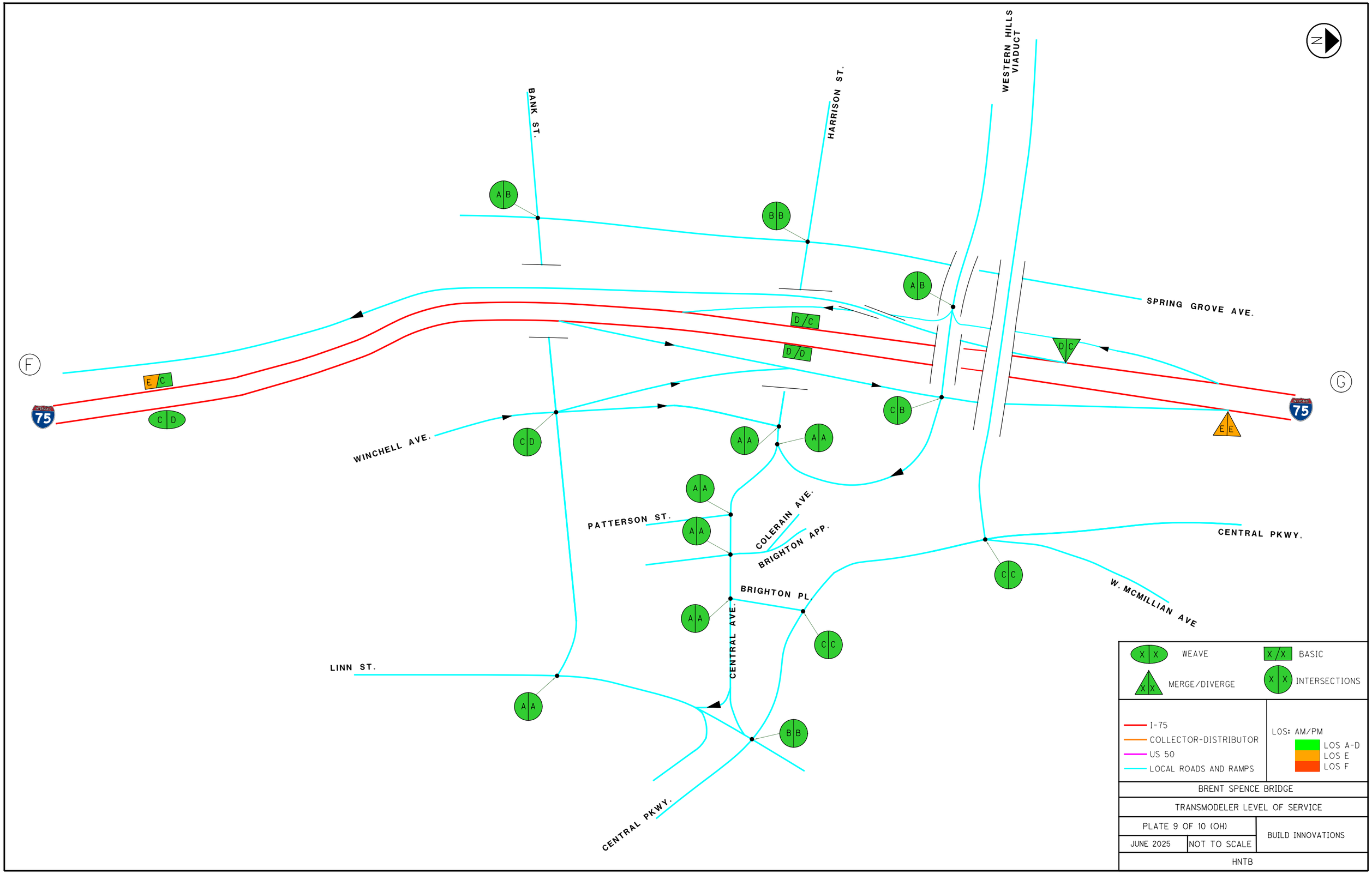
TRANSMODELER LEVEL OF SERVICE

PLATE 8 OF 10 (OH)

JUNE 2025 | NOT TO SCALE

BUILD INNOVATIONS

HNTB



BRENT SPENCE BRIDGE

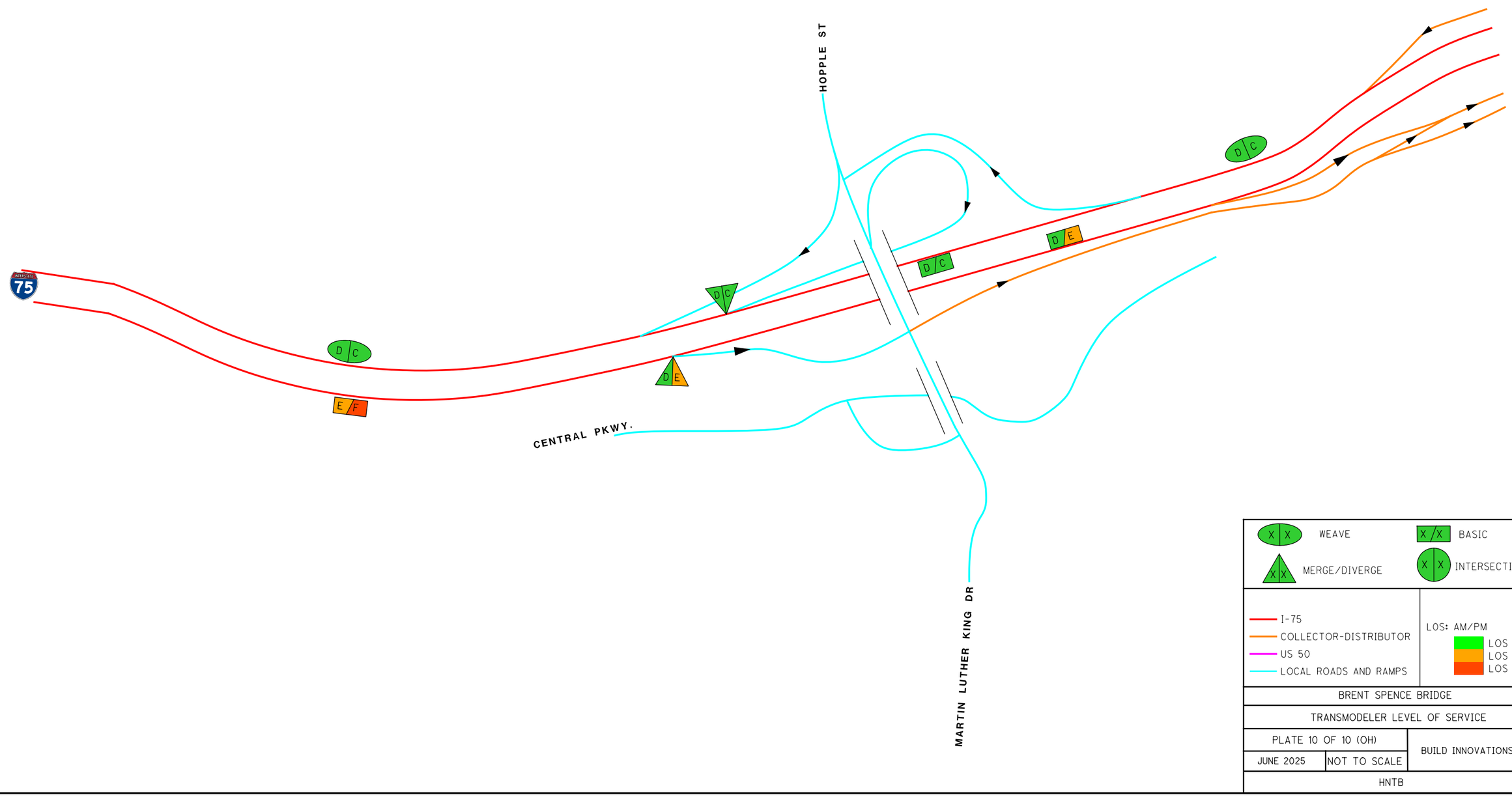
TRANSMODELER LEVEL OF SERVICE

PLATE 9 OF 10 (OH)

JUNE 2025 | NOT TO SCALE

BUILD INNOVATIONS

HNTB



BRENT SPENCE BRIDGE

TRANSMODELER LEVEL OF SERVICE

PLATE 10 OF 10 (OH)

JUNE 2025

NOT TO SCALE

BUILD INNOVATIONS

HNTB

Appendix D:
2049 Build Innovations Intersection Level of Service Tables

Node # 215	2049 AM Innovations					
NB I-75 & WHV	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	B	11.9	0.68	136	200	
EBT	B	10.5	0.05	94	2000	
EBR	-	-	-	-	-	
EB Approach	B	11.2	-	-	-	
WBL	-	-	-	-	-	
WBT	-	-	-	-	-	
WBR	-	-	-	-	-	
WB Approach	-	-	-	-	-	
NBL	B	19.1	0.46	137	300	
NBT	B	18.1	0.49	147	300	
NBR	-	-	-	-	-	
NB Approach	B	18.9	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	-	-	-	-	-	
SB Approach	-	-	-	-	-	
Intersection	B	15.3	-	-	-	

Node # 215	2049 PM Innovations				
NB I-75 & WHV	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	C	34.1	0.82	165	200
EBT	C	28.8	0.07	136	2000
EBR	-	-	-	-	-
EB Approach	C	31.6	-	-	-
WBL	-	-	-	-	-
WBT	-	-	-	-	-
WBR	-	-	-	-	-
WB Approach	-	-	-	-	-
NBL	B	10.3	0.48	143	300
NBT	A	6.0	0.27	82	300
NBR	-	-	-	-	-
NB Approach	A	8.0	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	B	14.6	-	-	-

Node # 217	2049 AM Innovations					
Linn St & Bank St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	B	12.3	0.21	18	85	
EBT	-	-	-	-	-	
EBR	A	4.7	0.00	2	640	
EB Approach	A	8.6	-	-	-	
WBL	-	-	-	-	-	
WBT	-	-	-	-	-	
WBR	-	-	-	-	-	
WB Approach	-	-	-	-	-	
NBL	A	1.3	-	0	-	
NBT	A	0.0	-	0	-	
NBR	-	-	-	-	-	
NB Approach	A	1.4	-	-	-	
SBL	-	-	-	-	-	
SBT	A	0.0	-	0	-	
SBR	A	0.0	-	0	-	
SB Approach	A	0.0	-	-	-	
Intersection	A	1.8	-	-	-	

Node # 217	2049 PM Innovations				
Linn St & Bank St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	C	26.8	0.48	40	85
EBT	-	-	-	-	-
EBR	A	5.2	0.02	16	640
EB Approach	B	17.2	-	-	-
WBL	-	-	-	-	-
WBT	-	-	-	-	-
WBR	-	-	-	-	-
WB Approach	-	-	-	-	-
NBL	A	3.6	-	23	-
NBT	A	0.4	-	0	-
NBR	-	-	-	-	-
NB Approach	A	3.6	-	-	-
SBL	-	-	-	-	-
SBT	A	0.0	-	0	-
SBR	A	0.0	-	0	-
SB Approach	A	0.0	-	-	-
Intersection	A	4.1	-	-	-

Node # 243	2049 AM Innovations					
Elm St & 4th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	-	-	-	-	-	
EBR	-	-	-	-	-	
EB Approach	-	-	-	-	-	
WBL	-	-	-	-	-	
WBT	B	14.1	0.02	8	340	
WBR	A	1.8	0.00	0	340	
WB Approach	A	6.6	-	-	-	
NBL	A	1.9	0.02	4	160	
NBT	B	13.0	0.58	93	160	
NBR	-	-	-	-	-	
NB Approach	A	9.9	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	-	-	-	-	-	
SB Approach	-	-	-	-	-	
Intersection	B	10.5	-	-	-	

Node # 243	2049 PM Innovations				
Elm St & 4th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	-	-	-	-	-
WBT	B	13.9	0.05	16	340
WBR	A	1.8	0.00	0	340
WB Approach	B	10.4	-	-	-
NBL	A	4.6	0.13	22	160
NBT	B	19.0	0.48	77	160
NBR	-	-	-	-	-
NB Approach	B	13.2	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	B	12.7	-	-	-

Node # 261	2049 AM Innovations					
Gest St & 8th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	C	34.1	0.25	150	590	
EBT	C	34.1	0.25	150	590	
EBR	B	10.1	0.12	69	590	
EB Approach	C	22.3	-	-	-	
WBL	B	19.5	0.20	16	80	
WBT	A	5.8	0.00	0	560	
WBR	A	5.8	0.00	0	560	
WB Approach	B	19.5	-	-	-	
NBL	C	34.1	0.35	93	265	
NBT	C	26.4	0.64	169	265	
NBR	B	12.6	0.17	45	265	
NB Approach	C	34.6	-	-	-	
SBL	C	27.2	0.05	54	1175	
SBT	C	27.2	0.05	54	1175	
SBR	C	27.2	0.09	107	1175	
SB Approach	C	28.5	-	-	-	
Intersection	C	25.5	-	-	-	

Node # 261	2049 PM Innovations				
Gest St & 8th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	C	34.4	0.26	154	590
EBT	C	34.4	0.26	154	590
EBR	B	11.7	0.06	33	590
EB Approach	C	27.5	-	-	-
WBL	C	22.5	0.22	18	80
WBT	B	13.9	0.01	4	560
WBR	B	13.9	0.01	4	560
WB Approach	C	20.6	-	-	-
NBL	C	31.0	0.33	87	265
NBT	C	25.5	0.49	130	265
NBR	B	16.2	0.20	53	265
NB Approach	C	27.3	-	-	-
SBL	C	33.8	0.07	80	1175
SBT	C	33.8	0.07	80	1175
SBR	C	33.0	0.07	137	1175
SB Approach	C	30.8	-	-	-
Intersection	C	27.8	-	-	-

Node # 270	2049 AM Innovations					
Linn St & Court St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	B	13.8	0.04	19	500	
EBT	B	13.8	0.04	19	500	
EBR	B	13.8	0.04	19	500	
EB Approach	B	11.9	-	-	-	
WBL	B	12.6	0.02	19	900	
WBT	B	12.6	0.02	19	900	
WBR	A	0.0	0.00	0	900	
WB Approach	B	12.4	-	-	-	
NBL	A	2.5	0.00	0	130	
NBT	A	0.0	0.00	0	860	
NBR	A	0.0	0.00	0	860	
NB Approach	A	0.1	-	-	-	
SBL	A	3.6	0.00	0	95	
SBT	A	0.0	0.00	0	700	
SBR	A	0.0	0.00	0	700	
SB Approach	A	0.3	-	-	-	
Intersection	A	2.8	-	-	-	

Node # 270	2049 PM Innovations				
Linn St & Court St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	F	159.7	0.35	173	500
EBT	F	159.7	0.35	173	500
EBR	F	159.7	0.35	173	500
EB Approach	F	159.7	-	-	-
WBL	F	263.4	0.25	224	900
WBT	F	263.4	0.25	224	900
WBR	A	5.6	0.02	16	900
WB Approach	F	203.0	-	-	-
NBL	A	5.1	0.00	0	130
NBT	A	0.0	0.00	0	860
NBR	A	0.0	0.00	0	860
NB Approach	A	0.3	-	-	-
SBL	A	3.1	0.00	0	95
SBT	A	0.0	0.00	0	700
SBR	A	0.0	0.00	0	700
SB Approach	A	0.3	-	-	-
Intersection	C	33.8	-	-	-

Node # 272	2049 AM Innovations					
Elm St & 2nd St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	A	8.6	0.00	0	400	
EBT	A	7.7	0.17	93	550	
EBR	A	9.7	0.25	139	550	
EB Approach	A	8.5	-	-	-	
WBL	-	-	-	-	-	
WBT	-	-	-	-	-	
WBR	-	-	-	-	-	
WB Approach	-	-	-	-	-	
NBL	-	-	-	-	-	
NBT	C	27.7	0.41	127	310	
NBR	B	15.8	0.00	0	310	
NB Approach	C	26.7	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	-	-	-	-	-	
SB Approach	-	-	-	-	-	
Intersection	B	10.7	-	-	-	

Node # 272	2049 PM Innovations				
Elm St & 2nd St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	E	68.1	0.00	0	400
EBT	B	16.4	0.25	139	550
EBR	A	7.5	0.13	74	550
EB Approach	B	13.5	-	-	-
WBL	-	-	-	-	-
WBT	-	-	-	-	-
WBR	-	-	-	-	-
WB Approach	-	-	-	-	-
NBL	-	-	-	-	-
NBT	E	67.3	1.02	317	310
NBR	B	14.6	0.00	0	310
NB Approach	E	65.2	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	C	27.0	-	-	-

Node # 283	2049 AM Innovations					
Race St & 3rd St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	-	-	-	-	-	
EBR	-	-	-	-	-	
EB Approach	-	-	-	-	-	
WBL	A	2.8	0.01	6	410	
WBT	B	11.2	0.21	88	410	
WBR	-	-	-	-	-	
WB Approach	B	10.2	-	-	-	
NBL	-	-	-	-	-	
NBT	-	-	-	-	-	
NBR	-	-	-	-	-	
NB Approach	-	-	-	-	-	
SBL	-	-	-	-	-	
SBT	B	17.0	0.09	33	370	
SBR	B	11.5	0.21	50	235	
SB Approach	B	15.6	-	-	-	
Intersection	B	11.9	-	-	-	

Node # 283	2049 PM Innovations				
Race St & 3rd St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	A	3.4	0.02	7	410
WBT	C	25.2	0.71	290	410
WBR	-	-	-	-	-
WB Approach	C	21.7	-	-	-
NBL	-	-	-	-	-
NBT	-	-	-	-	-
NBR	-	-	-	-	-
NB Approach	-	-	-	-	-
SBL	-	-	-	-	-
SBT	C	24.9	0.42	157	370
SBR	D	45.7	1.39	328	235
SB Approach	D	36.5	-	-	-
Intersection	C	27.5	-	-	-

Node # 287	2049 AM Innovations					
Elm St & 3rd St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-		
EBT	-	-	-	-		
EBR	-	-	-	-		
EB Approach	-	-	-	-	-	
WBL	-	-	-	-	-	
WBT	B	12.9	0.18	68	370	
WBR	B	14.4	0.97	126	130	
WB Approach	B	13.0	-	-	-	
NBL	A	3.5	0.07	10	150	
NBT	C	28.7	0.67	100	150	
NBR	-	-	-	-	-	
NB Approach	B	16.3	-	-	-	
SBL	-	-	-	-		
SBT	-	-	-	-		
SBR	-	-	-	-		
SB Approach	-	-	-	-	-	
Intersection	B	14.6	-	-	-	

Node # 287	2049 PM Innovations				
Elm St & 3rd St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	0
EBT	-	-	-	-	0
EBR	-	-	-	-	0
EB Approach	-	-	-	-	-
WBL	-	-	-	-	-
WBT	A	8.4	0.09	33	370
WBR	A	5.8	0.48	62	130
WB Approach	A	8.1	-	-	-
NBL	E	57.7	0.70	105	150
NBT	C	27.0	0.40	61	150
NBR	-	-	-	-	-
NB Approach	D	51.5	-	-	-
SBL	-	-	-	-	0
SBT	-	-	-	-	0
SBR	-	-	-	-	0
SB Approach	-	-	-	-	-
Intersection	B	15.4	-	-	-

Node # 291	2049 AM Innovations					
Central Ave & 5th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	B	13.2	0.39	105	270	
EBT	B	14.7	0.47	127	270	
EBR	B	14.1	0.38	103	270	
EB Approach	B	14.3	-	-	-	
WBL	-	-	-	-	-	
WBT	-	-	-	-	-	
WBR	-	-	-	-	-	
WB Approach	-	-	-	-	-	
NBL	-	-	-	-	-	
NBT	C	26.6	0.35	125	360	
NBR	D	42.6	0.45	163	360	
NB Approach	D	36.8	-	-	-	
SBL	C	34.5	0.21	56	270	
SBT	A	8.3	0.04	17	395	
SBR	-	-	-	-	-	
SB Approach	C	24.0	-	-	-	
Intersection	C	21.0	-	-	-	

Node # 291	2049 PM Innovations				
Central Ave & 5th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	C	20.0	0.33	89	270
EBT	C	20.4	0.30	80	270
EBR	B	18.5	0.16	44	270
EB Approach	B	19.6	-	-	-
WBL	-	-	-	-	-
WBT	-	-	-	-	-
WBR	-	-	-	-	-
WB Approach	-	-	-	-	-
NBL	-	-	-	-	-
NBT	C	33.8	0.49	175	360
NBR	C	26.5	0.42	152	360
NB Approach	C	29.6	-	-	-
SBL	C	29.8	0.17	46	270
SBT	A	1.2	0.00	0	395
SBR	-	-	-	-	-
SB Approach	B	14.1	-	-	-
Intersection	C	22.5	-	-	-

Node # 295	2049 AM Innovations					
Gest St & 6th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Stop
EBL	-	-	-	-	-	
EBT	-	-	-	-	-	
EBR	-	-	-	-	-	
EB Approach	-	-	-	-	-	
WBL	C	15.5	0.10	107	1025	
WBT	-	-	-	-	-	
WBR	C	15.5	0.10	107	1025	
WB Approach	B	14.4	-	-	-	
NBL	-	-	-	-	-	
NBT	A	0.2	0.00	0	570	
NBR	-	-	-	-	-	
NB Approach	A	0.0	-	-	-	
SBL	-	-	-	-	-	
SBT	A	0.0	0.00	0	265	
SBR	-	-	-	-	-	
SB Approach	A	0.0	-	-	-	
Intersection	A	4.6	-	-	-	

Node # 295	2049 PM Innovations				
Gest St & 6th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	B	13.9	0.09	91	1025
WBT	-	-	-	-	-
WBR	B	13.9	0.09	91	1025
WB Approach	B	13.9	-	-	-
NBL	-	-	-	-	-
NBT	A	0.2	0.00	0	570
NBR	-	-	-	-	-
NB Approach	A	0.2	-	-	-
SBL	-	-	-	-	-
SBT	A	0.0	0.00	0	265
SBR	-	-	-	-	-
SB Approach	A	0.0	-	-	-
Intersection	A	6.0	-	-	-

Node # 299	2049 AM Innovations					
Plum St & 3rd St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	-	-	-	-	-	
EBR	-	-	-	-	-	
EB Approach	-	-	-	-	-	
WBL	-	-	-	-	-	
WBT	A	6.3	0.06	26	400	
WBR	-	-	-	-	-	
WB Approach	A	6.1	-	-	-	
NBL	-	-	-	-	-	
NBT	-	-	-	-	-	
NBR	-	-	-	-	-	
NB Approach	-	-	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	A	2.7	0.00	0	390	
SB Approach	A	2.4	-	-	-	
Intersection	A	5.5	-	-	-	

Node # 299	2049 PM Innovations				
Plum St & 3rd St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	-	-	-	-	-
WBT	A	7.2	0.09	34	400
WBR	-	-	-	-	-
WB Approach	A	7.2	-	-	-
NBL	-	-	-	-	-
NBT	-	-	-	-	-
NBR	-	-	-	-	-
NB Approach	-	-	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	A	4.3	0.05	21	390
SB Approach	A	4.3	-	-	-
Intersection	A	6.1	-	-	-

Node # 305	2049 AM Innovations					
Plum St & 4th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	-	-	-	-	-	
EBR	-	-	-	-	-	
EB Approach	-	-	-	-	-	
WBL	A	0.5	0.00	0	50	
WBT	B	15.3	0.08	32	400	
WBR	-	-	-	-	-	
WB Approach	B	13.3	-	-	-	
NBL	-	-	-	-	-	
NBT	-	-	-	-	-	
NBR	-	-	-	-	-	
NB Approach	-	-	-	-	-	
SBL	-	-	-	-	-	
SBT	B	13.6	0.04	16	385	
SBR	A	7.2	-	17	-	
SB Approach	A	8.7	-	-	-	
Intersection	B	11.2	-	-	-	

Node # 305	2049 PM Innovations				
Plum St & 4th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	A	0.8	0.00	0	50
WBT	B	16.2	0.11	42	400
WBR	-	-	-	-	-
WB Approach	B	12.2	-	-	-
NBL	-	-	-	-	-
NBT	-	-	-	-	-
NBR	-	-	-	-	-
NB Approach	-	-	-	-	-
SBL	-	-	-	-	-
SBT	B	12.7	0.09	33	385
SBR	B	10.1	-	46	-
SB Approach	B	11.4	-	-	-
Intersection	B	11.7	-	-	-

Node # 306	2049 AM Innovations					
Spring Grove Ave & Harrison	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	B	17.2	0.03	15	425	
EBT	B	12.2	0.04	17	425	
EBR	A	7.3	0.04	17	425	
EB Approach	A	9.8	-	-	-	
WBL	C	20.0	0.05	45	830	
WBT	B	13.2	0.05	45	830	
WBR	A	6.4	0.02	18	830	
WB Approach	B	12.2	-	-	-	
NBL	B	16.1	0.02	19	925	
NBT	A	1.1	0.00	0	925	
NBR	A	1.8	0.00	0	925	
NB Approach	A	6.3	-	-	-	
SBL	B	18.7	0.18	32	175	
SBT	B	10.5	0.08	36	450	
SBR	B	10.4	0.08	35	450	
SB Approach	B	11.8	-	-	-	
Intersection	B	10.3	-	-	-	

Node # 306	2049 PM Innovations				
Spring Grove Ave & Harrison	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	B	16.5	0.04	15	425
EBT	B	12.0	0.04	17	425
EBR	A	7.5	0.04	17	425
EB Approach	A	8.9	-	-	-
WBL	B	15.8	0.05	46	830
WBT	B	11.6	0.05	46	830
WBR	A	7.5	0.02	20	830
WB Approach	B	11.7	-	-	-
NBL	C	31.4	0.10	94	925
NBT	B	17.5	0.05	44	925
NBR	A	1.3	0.01	12	925
NB Approach	B	12.7	-	-	-
SBL	C	26.9	0.26	46	175
SBT	B	10.5	0.10	45	450
SBR	B	10.9	0.10	43	450
SB Approach	B	13.6	-	-	-
Intersection	B	12.7	-	-	-

Node # 324	2049 AM Innovations					
Linn St & WB 6th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	C	22.2	0.01	16	2280	
EBT	-	-	-	-	-	
EBR	A	0.0	0.00	0	2280	
EB Approach	A	3.8	-	-	-	
WBL	C	21.3	0.04	17	400	
WBT	C	23.4	0.09	63	725	
WBR	C	20.0	0.23	79	350	
WB Approach	C	21.3	-	-	-	
NBL	C	30.8	0.34	42	125	
NBT	C	22.8	0.06	20	350	
NBR	-	-	-	-	-	
NB Approach	C	27.1	-	-	-	
SBL	-	-	-	-	-	
SBT	C	22.4	0.10	51	530	
SBR	B	14.7	0.10	51	530	
SB Approach	C	20.9	-	-	-	
Intersection	B	19.6	-	-	-	

Node # 324	2049 PM Innovations				
Linn St & WB 6th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	C	25.8	0.01	17	2280
EBT	-	-	-	-	-
EBR	A	0.0	0.00	0	2280
EB Approach	A	1.7	-	-	-
WBL	C	32.3	0.11	42	400
WBT	C	24.9	0.04	28	725
WBR	B	16.0	0.12	42	350
WB Approach	C	21.5	-	-	-
NBL	C	32.8	0.34	42	125
NBT	C	23.4	0.10	36	350
NBR	-	-	-	-	-
NB Approach	C	26.2	-	-	-
SBL	-	-	-	-	-
SBT	C	24.4	0.14	74	530
SBR	B	14.5	0.14	74	530
SB Approach	C	24.2	-	-	-
Intersection	B	16.0	-	-	-

Node # 325	2049 AM Innovations					
Mound St & 9th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Stop
EBL	-	-	-	-	-	
EBT	-	-	-	-	-	
EBR	-	-	-	-	-	
EB Approach	-	-	-	-	-	
WBL	-	-	-	-	-	
WBT	A	0.2	-	0	-	
WBR	A	0.3	-	0	-	
WB Approach	A	0.1	-	-	-	
NBL	-	-	-	-	-	
NBT	-	-	-	-	-	
NBR	-	-	-	-	-	
NB Approach	-	-	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	B	10.9	0.03	18	520	
SB Approach	B	10.4	-	-	-	
Intersection	A	1.5	-	-	-	

Node # 325	2049 PM Innovations				
Mound St & 9th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	-	-	-	-	-
WBT	B	12.1	-	57	-
WBR	A	5.0	-	5	-
WB Approach	A	8.4	-	-	-
NBL	-	-	-	-	-
NBT	-	-	-	-	-
NBR	-	-	-	-	-
NB Approach	-	-	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	C	23.5	0.10	53	520
SB Approach	C	23.5	-	-	-
Intersection	A	9.5	-	-	-

Node # 329	2049 AM Innovations					
Linn St & Ezzard Charles Dr	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	D	36.1	0.13	23	180	
EBT	C	29.7	0.09	74	830	
EBR	C	27.6	0.13	108	830	
EB Approach	C	25.2	-	-	-	
WBL	C	32.0	0.11	19	175	
WBT	C	25.3	0.06	74	1185	
WBR	C	24.8	0.06	74	1185	
WB Approach	C	26.1	-	-	-	
NBL	C	31.3	0.25	50	200	
NBT	C	21.2	0.11	48	430	
NBR	A	4.8	0.28	14	50	
NB Approach	C	20.0	-	-	-	
SBL	D	47.8	0.12	25	200	
SBT	C	22.5	0.11	66	620	
SBR	B	10.5	0.00	0	50	
SB Approach	C	24.8	-	-	-	
Intersection	C	24.6	-	-	-	

Node # 329	2049 PM Innovations				
Linn St & Ezzard Charles Dr	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	D	38.8	0.10	19	180
EBT	C	26.5	0.05	45	830
EBR	C	20.3	0.11	88	830
EB Approach	C	24.2	-	-	-
WBL	C	32.4	0.27	47	175
WBT	C	28.2	0.11	130	1185
WBR	C	31.0	0.11	130	1185
WB Approach	C	30.7	-	-	-
NBL	C	33.5	0.38	76	200
NBT	C	21.5	0.15	62	430
NBR	A	4.1	0.00	0	50
NB Approach	C	22.8	-	-	-
SBL	E	67.0	0.24	49	200
SBT	C	26.0	0.22	134	620
SBR	B	19.4	0.00	0	50
SB Approach	C	27.9	-	-	-
Intersection	C	26.7	-	-	-

Node # 334	2049 AM Innovations					
Patterson St & Harrison St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	A	0.2	0.00	0	825	
EBR	A	0.0	0.00	0	825	
EB Approach	A	0.1	-	-	-	
WBL	A	0.0	0.00	0	185	
WBT	A	0.0	0.00	0	185	
WBR	-	-	-	-	-	
WB Approach	A	0.0	-	-	-	
NBL	-	-	-	-	-	
NBT	A	3.5	0.00	1	770	
NBR	A	3.5	0.00	1	770	
NB Approach	A	3.7	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	-	-	-	-	-	
SB Approach	-	-	-	-	-	
Intersection	A	0.8	-	-	-	

Node # 334	2049 PM Innovations				
Patterson St & Harrison St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	A	0.2	0.00	0	825
EBR	A	0.0	0.00	0	825
EB Approach	A	0.2	-	-	-
WBL	A	0.0	0.00	0	185
WBT	A	0.0	0.00	0	185
WBR	-	-	-	-	-
WB Approach	A	0.0	-	-	-
NBL	-	-	-	-	-
NBT	A	4.0	0.01	6	770
NBR	A	4.0	0.01	6	770
NB Approach	A	4.0	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	A	0.6	-	-	-

Node # 338	2049 AM Innovations					
NB Arterial & 6th Street	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	-	-	-	-	-	
EBR	-	-	-	-	-	
EB Approach	-	-	-	-	-	
WBL	-	-	-	-	-	
WBT	F	91.3	0.53	191	360	
WBR	D	39.5	0.28	99	360	
WB Approach	F	83.3	-	-	-	
NBL	A	2.7	0.07	18	245	
NBT	E	58.1	0.34	187	550	
NBR	-	-	-	-	-	
NB Approach	E	59.9	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	-	-	-	-	-	
SB Approach	-	-	-	-	-	
Intersection	D	53.8	-	-	-	

Node # 338	2049 PM Innovations				
NB Arterial & 6th Street	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	-	-	-	-	-
WBT	A	8.5	0.30	109	360
WBR	A	3.4	0.07	24	360
WB Approach	A	7.0	-	-	-
NBL	C	21.2	0.22	55	245
NBT	D	44.3	0.17	95	550
NBR	-	-	-	-	-
NB Approach	D	39.0	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	B	14.5	-	-	-

Node # 344	2049 AM Innovations					
Dalton Ave & Findlay St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	C	34.4	0.84	42	50	
EBT	C	24.2	0.11	50	475	
EBR	C	24.2	0.11	50	475	
EB Approach	C	28.4	-	-	-	
WBL	D	35.1	0.46	66	145	
WBT	A	0.0	0.00	0	290	
WBR	A	4.4	0.08	22	290	
WB Approach	B	17.7	-	-	-	
NBL	A	0.0	0.00	0	135	
NBT	C	20.9	0.05	35	680	
NBR	B	19.9	0.08	55	680	
NB Approach	C	20.4	-	-	-	
SBL	C	26.3	0.23	60	260	
SBT	A	9.6	0.03	34	1200	
SBR	A	8.9	0.04	43	1200	
SB Approach	B	13.3	-	-	-	
Intersection	B	17.2	-	-	-	

Node # 344	2049 PM Innovations				
Dalton Ave & Findlay St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	D	36.8	0.94	47	50
EBT	C	28.0	0.15	73	475
EBR	C	28.0	0.15	73	475
EB Approach	C	30.9	-	-	-
WBL	D	49.8	0.78	113	145
WBT	A	2.9	0.01	2	290
WBR	A	6.9	0.18	51	290
WB Approach	C	26.6	-	-	-
NBL	A	0.0	0.00	0	135
NBT	C	20.5	0.07	49	680
NBR	B	19.5	0.11	74	680
NB Approach	C	20.1	-	-	-
SBL	D	51.0	0.53	137	260
SBT	B	10.7	0.04	46	1200
SBR	A	9.6	0.04	48	1200
SB Approach	C	22.0	-	-	-
Intersection	C	23.9	-	-	-

Node # 349	2049 AM Innovations					
NB I-75 & 5th Street	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	C	32.3	0.30	172	570	
EBT	C	33.1	0.15	151	1000	
EBR	-	-	-	-	-	
EB Approach	C	32.3	-	-	-	
WBL	-	-	-	-	-	
WBT	-	-	-	-	-	
WBR	-	-	-	-	-	
WB Approach	-	-	-	-	-	
NBL	-	-	-	-	-	
NBT	C	24.7	0.07	148	2000	
NBR	B	16.0	0.01	24	2000	
NB Approach	C	34.0	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	-	-	-	-	-	
SB Approach	-	-	-	-	-	
Intersection	C	26.3	-	-	-	

Node # 349	2049 PM Innovations				
NB I-75 & 5th Street	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	C	24.9	0.16	89	570
EBT	C	27.6	0.07	72	1000
EBR	-	-	-	-	-
EB Approach	C	26.3	-	-	-
WBL	-	-	-	-	-
WBT	-	-	-	-	-
WBR	-	-	-	-	-
WB Approach	-	-	-	-	-
NBL	-	-	-	-	-
NBT	A	4.8	0.01	28	2000
NBR	A	1.2	0.00	0	2000
NB Approach	-	-	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	B	13.3	-	-	-

Node # 350	2049 AM Innovations					
Linn St & Central Pkwy	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	B	11.2	0.20	61	310	
EBT	B	11.5	0.28	86	310	
EBR	B	11.9	0.28	86	310	
EB Approach	B	11.3	-	-	-	
WBL	C	20.5	0.29	35	120	
WBT	B	17.5	0.03	35	1300	
WBR	B	14.5	0.02	28	1300	
WB Approach	B	16.0	-	-	-	
NBL	C	24.6	0.37	71	190	
NBT	B	14.5	0.09	42	490	
NBR	A	5.8	0.03	6	180	
NB Approach	B	19.1	-	-	-	
SBL	B	16.4	0.63	47	75	
SBT	B	16.4	0.63	47	75	
SBR	A	4.6	0.20	15	75	
SB Approach	B	10.8	-	-	-	
Intersection	B	13.8	-	-	-	

Node # 350	2049 PM Innovations				
Linn St & Central Pkwy	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	A	9.3	0.14	43	310
EBT	A	9.7	0.23	71	310
EBR	B	10.1	0.23	71	310
EB Approach	A	9.8	-	-	-
WBL	C	22.0	0.60	72	120
WBT	B	18.1	0.06	72	1300
WBR	B	14.2	0.04	58	1300
WB Approach	B	17.9	-	-	-
NBL	D	45.3	0.67	127	190
NBT	B	15.8	0.05	22	490
NBR	A	4.8	0.09	16	180
NB Approach	C	32.3	-	-	-
SBL	B	16.1	1.28	96	75
SBT	B	16.1	1.28	96	75
SBR	A	5.4	0.04	3	75
SB Approach	B	14.2	-	-	-
Intersection	B	17.4	-	-	-

Node # 359	2049 AM Innovations					
Colerain Ave & Harrison St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	A	0.6	-	0	-	
EBT	A	0.3	-	0	-	
EBR	A	0.1	-	0	-	
EB Approach	A	0.4	-	-	-	
WBL	A	0.0	-	0	-	
WBT	A	0.0	-	0	-	
WBR	A	0.0	-	0	-	
WB Approach	A	0.0	-	-	-	
NBL	-	-	-	-	-	
NBT	-	-	-	-	-	
NBR	-	-	-	-	-	
NB Approach	-	-	-	-	-	
SBL	A	5.1	0.00	2	700	
SBT	A	5.1	0.00	2	700	
SBR	A	5.1	0.00	2	700	
SB Approach	A	5.5	-	-	-	
Intersection	A	1.0	-	-	-	

Node # 359	2049 PM Innovations				
Colerain Ave & Harrison St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	A	1.2	-	0	-
EBT	A	0.7	-	0	-
EBR	A	0.2	-	0	-
EB Approach	A	0.9	-	-	-
WBL	A	0.0	-	0	-
WBT	A	0.0	-	0	-
WBR	A	0.0	-	0	-
WB Approach	A	0.0	-	-	-
NBL	-	-	-	-	-
NBT	-	-	-	-	-
NBR	-	-	-	-	-
NB Approach	-	-	-	-	-
SBL	A	9.0	0.02	16	700
SBT	A	9.0	0.02	16	700
SBR	A	9.0	0.02	16	700
SB Approach	A	9.0	-	-	-
Intersection	A	1.5	-	-	-

Node # 362	2049 AM Innovations					
Brighton Pl & Central Pkwy	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	D	43.0	0.13	191	1500	
EBR	D	40.8	0.13	194	1500	
EB Approach	D	42.3	-	-	-	
WBL	A	7.8	0.09	10	110	
WBT	B	10.0	0.06	50	825	
WBR	-	-	-	-	-	
WB Approach	A	9.8	-	-	-	
NBL	B	16.4	0.12	15	120	
NBT	-	-	-	-	-	
NBR	A	7.4	0.14	17	120	
NB Approach	A	9.8	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	-	-	-	-	-	
SB Approach	-	-	-	-	-	
Intersection	C	27.5	-	-	-	

Node # 362	2049 PM Innovations				
Brighton Pl & Central Pkwy	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	D	42.4	0.11	158	1500
EBR	D	38.1	0.11	164	1500
EB Approach	D	40.2	-	-	-
WBL	B	10.5	0.25	27	110
WBT	A	4.5	0.04	36	825
WBR	-	-	-	-	-
WB Approach	A	5.9	-	-	-
NBL	C	22.8	0.28	33	120
NBT	-	-	-	-	-
NBR	A	3.5	0.13	16	120
NB Approach	B	10.7	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	C	20.8	-	-	-

Node # 363	2049 AM Innovations					
Brighton Pl & Central Ave	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	A	5.0	0.49	17	35	
EBT	A	3.7	0.00	0	35	
EBR	-	-	-	-	-	
EB Approach	A	4.8	-	-	-	
WBL	-	-	-	-	-	
WBT	A	0.0	0.00	0	60	
WBR	A	5.0	0.01	1	40	
WB Approach	A	4.8	-	-	-	
NBL	-	-	-	-	-	
NBT	-	-	-	-	-	
NBR	-	-	-	-	-	
NB Approach	-	-	-	-	-	
SBL	A	0.0	0.00	0	50	
SBT	-	-	-	-	-	
SBR	A	0.0	0.00	0	50	
SB Approach	A	0.0	-	-	-	
Intersection	A	2.7	-	-	-	

Node # 363	2049 PM Innovations				
Brighton Pl & Central Ave	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	A	6.8	0.61	21	35
EBT	A	5.9	0.09	3	35
EBR	-	-	-	-	-
EB Approach	A	6.7	-	-	-
WBL	-	-	-	-	-
WBT	A	5.3	0.00	0	60
WBR	A	6.0	0.40	16	40
WB Approach	A	6.1	-	-	-
NBL	-	-	-	-	-
NBT	-	-	-	-	-
NBR	-	-	-	-	-
NB Approach	-	-	-	-	-
SBL	A	0.0	0.00	0	50
SBT	-	-	-	-	-
SBR	A	0.0	0.00	0	50
SB Approach	A	0.0	-	-	-
Intersection	A	3.7	-	-	-

Node # 366	2049 AM Innovations					
Central Ave & 3rd St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	D	43.3	0.31	81	260	
EBT	-	-	-	-	-	
EBR	B	15.4	0.28	47	165	
EB Approach	C	32.4	-	-	-	
WBL	D	53.3	0.51	178	350	
WBT	D	44.7	0.26	92	350	
WBR	D	45.6	0.40	141	350	
WB Approach	D	48.5	-	-	-	
NBL	C	33.3	0.12	20	160	
NBT	C	30.0	0.06	28	445	
NBR	-	-	-	-	-	
NB Approach	C	33.9	-	-	-	
SBL	-	-	-	-	-	
SBT	D	41.1	0.12	44	370	
SBR	D	46.3	0.23	84	370	
SB Approach	D	44.9	-	-	-	
Intersection	D	41.5	-	-	-	

Node # 366	2049 PM Innovations				
Central Ave & 3rd St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	D	42.0	0.24	63	260
EBT	-	-	-	-	-
EBR	C	25.2	0.28	46	165
EB Approach	D	36.4	-	-	-
WBL	C	31.1	0.26	93	350
WBT	D	36.5	0.73	256	350
WBR	C	33.3	0.50	175	350
WB Approach	C	34.3	-	-	-
NBL	D	51.8	0.36	57	160
NBT	D	45.8	0.14	64	445
NBR	-	-	-	-	-
NB Approach	D	47.4	-	-	-
SBL	-	-	-	-	-
SBT	D	40.2	0.14	53	370
SBR	D	44.9	0.34	127	370
SB Approach	D	43.5	-	-	-
Intersection	D	38.5	-	-	-

Node # 395	2049 AM Innovations					
McMillian Ave & Central Pkwy	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	B	18.0	0.13	33	250	
EBT	C	29.1	0.03	70	2000	
EBR	A	9.0	0.36	43	120	
EB Approach	B	18.9	-	-	-	
WBL	B	16.8	0.00	0	120	
WBT	C	27.3	0.06	46	770	
WBR	C	25.5	0.40	49	120	
WB Approach	C	26.6	-	-	-	
NBL	B	15.5	0.09	18	200	
NBT	B	11.3	0.04	32	875	
NBR	B	10.2	0.35	35	100	
NB Approach	B	12.1	-	-	-	
SBL	B	17.4	0.17	10	60	
SBT	C	27.2	0.05	95	2000	
SBR	C	28.8	0.06	114	2000	
SB Approach	C	26.9	-	-	-	
Intersection	C	20.2	-	-	-	

Node # 395	2049 PM Innovations				
McMillian Ave & Central Pkwy	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	C	20.6	0.22	54	250
EBT	C	28.5	0.03	50	2000
EBR	A	9.2	0.35	42	120
EB Approach	B	18.5	-	-	-
WBL	B	11.8	0.00	0	120
WBT	C	28.3	0.10	80	770
WBR	C	29.2	0.66	79	120
WB Approach	C	28.6	-	-	-
NBL	C	22.1	0.16	32	200
NBT	B	14.3	0.05	47	875
NBR	B	14.4	0.56	56	100
NB Approach	B	17.1	-	-	-
SBL	A	5.4	0.00	0	60
SBT	C	27.0	0.04	77	2000
SBR	C	26.4	0.07	131	2000
SB Approach	C	26.8	-	-	-
Intersection	C	21.6	-	-	-

Node # 419	2049 AM Innovations					
Winchell Ave & Bank St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Stop
EBL	E	42.7	0.43	106	250	
EBT	A	8.2	0.12	38	315	
EBR	-	-	-	-	-	
EB Approach	D	26.6	-	-	-	
WBL	-	-	-	-	-	
WBT	C	20.2	0.13	39	315	
WBR	C	20.8	0.49	88	180	
WB Approach	C	19.7	-	-	-	
NBL	D	27.6	0.90	113	125	
NBT	D	28.2	0.94	169	180	
NBR	B	13.4	0.10	18	180	
NB Approach	D	26.1	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	-	-	-	-	-	
SB Approach	-	-	-	-	-	
Intersection	C	24.7	-	-	-	

Node # 419	2049 PM Innovations				
Winchell Ave & Bank St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	F	54.4	0.72	179	250
EBT	A	7.1	0.24	77	315
EBR	-	-	-	-	-
EB Approach	D	31.8	-	-	-
WBL	-	-	-	-	-
WBT	B	12.8	0.14	44	315
WBR	B	14.9	0.43	78	180
WB Approach	B	14.1	-	-	-
NBL	E	38.3	1.92	240	125
NBT	D	27.8	0.61	110	180
NBR	C	24.9	0.38	68	180
NB Approach	D	32.2	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	D	27.6	-	-	-

Node # 426	2049 AM Innovations					
Winchell Ave & Harrison St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	A	0.0	-	0	-	
EBR	-	-	-	-	-	
EB Approach	A	0.0	-	-	-	
WBL	-	-	-	-	-	
WBT	A	0.0	-	0	-	
WBR	-	-	-	-	-	
WB Approach	A	0.0	-	-	-	
NBL	A	3.6	0.00	0	1050	
NBT	-	-	-	-	-	
NBR	A	3.6	0.00	0	1050	
NB Approach	A	3.3	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	-	-	-	-	-	
SB Approach	-	-	-	-	-	
Intersection	A	0.2	-	-	-	

Node # 426	2049 PM Innovations				
Winchell Ave & Harrison St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	A	0.0	-	0	-
EBR	-	-	-	-	-
EB Approach	A	0.0	-	-	-
WBL	-	-	-	-	-
WBT	A	0.0	-	0	-
WBR	-	-	-	-	-
WB Approach	A	0.0	-	-	-
NBL	A	4.3	0.02	17	1050
NBT	-	-	-	-	-
NBR	A	4.3	0.02	17	1050
NB Approach	A	4.3	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	A	0.9	-	-	-

Node # 437	2049 AM Innovations					
Winchell Ave & Ezzard Charles	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	B	16.2	0.00	0	200	
EBT	B	14.8	0.16	43	270	
EBR	-	-	-	-	-	
EB Approach	B	14.0	-	-	-	
WBL	-	-	-	-	-	
WBT	B	13.3	0.08	70	850	
WBR	A	8.1	0.00	0	150	
WB Approach	B	12.7	-	-	-	
NBL	B	13.3	0.29	153	525	
NBT	A	9.9	0.17	90	525	
NBR	B	11.5	0.18	97	525	
NB Approach	B	11.9	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	-	-	-	-	-	
SB Approach	-	-	-	-	-	
Intersection	B	11.6	-	-	-	

Node # 437	2049 PM Innovations				
Winchell Ave & Ezzard Charles	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	D	39.1	0.29	57	200
EBT	B	10.7	0.11	31	270
EBR	-	-	-	-	-
EB Approach	B	17.5	-	-	-
WBL	-	-	-	-	-
WBT	B	17.0	0.16	137	850
WBR	B	10.1	0.00	0	150
WB Approach	B	17.2	-	-	-
NBL	C	24.3	0.48	252	525
NBT	B	19.2	0.30	155	525
NBR	B	15.1	0.21	113	525
NB Approach	C	20.3	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	B	19.6	-	-	-

Node # 438	2049 AM Innovations					
Western Ave & Ezzard Charles	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	A	9.2	0.05	12	250	
EBR	A	7.5	0.07	17	250	
EB Approach	A	8.9	-	-	-	
WBL	B	16.1	0.61	61	100	
WBT	A	10.0	0.06	16	250	
WBR	-	-	-	-	-	
WB Approach	B	15.0	-	-	-	
NBL	-	-	-	-	-	
NBT	-	-	-	-	-	
NBR	-	-	-	-	-	
NB Approach	-	-	-	-	-	
SBL	A	7.7	0.19	33	180	
SBT	A	6.7	0.07	33	500	
SBR	A	6.4	0.05	26	500	
SB Approach	A	6.9	-	-	-	
Intersection	A	9.8	-	-	-	

Node # 438	2049 PM Innovations				
Western Ave & Ezzard Charles	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	B	11.0	0.08	19	250
EBR	A	6.8	0.06	16	250
EB Approach	A	9.5	-	-	-
WBL	B	16.7	0.48	48	100
WBT	B	10.9	0.07	18	250
WBR	-	-	-	-	-
WB Approach	B	15.8	-	-	-
NBL	-	-	-	-	-
NBT	-	-	-	-	-
NBR	-	-	-	-	-
NB Approach	-	-	-	-	-
SBL	A	6.7	0.13	23	180
SBT	A	6.5	0.09	47	500
SBR	A	6.5	0.09	47	500
SB Approach	A	6.6	-	-	-
Intersection	A	9.0	-	-	-

Node # 488	2049 AM Innovations					
Central Ave & 6th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	-	-	-	-	-	
EBR	-	-	-	-	-	
EB Approach	-	-	-	-	-	
WBL	B	17.2	0.39	114	295	
WBT	B	15.4	0.24	71	295	
WBR	A	6.1	0.06	18	295	
WB Approach	B	15.3	-	-	-	
NBL	B	17.2	0.08	22	280	
NBT	A	1.7	0.00	0	410	
NBR	-	-	-	-	-	
NB Approach	A	5.6	-	-	-	
SBL	-	-	-	-	-	
SBT	B	16.7	0.07	19	290	
SBR	B	15.4	0.06	18	290	
SB Approach	B	16.1	-	-	-	
Intersection	B	12.0	-	-	-	

Node # 488	2049 PM Innovations				
Central Ave & 6th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	F	81.0	1.54	454	295
WBT	D	48.0	1.16	341	295
WBR	A	9.9	0.25	73	295
WB Approach	D	54.2	-	-	-
NBL	C	28.2	0.19	54	280
NBT	B	10.5	0.01	6	410
NBR	-	-	-	-	-
NB Approach	B	19.9	-	-	-
SBL	-	-	-	-	-
SBT	D	39.6	0.06	19	290
SBR	D	35.1	0.00	0	290
SB Approach	D	39.6	-	-	-
Intersection	D	48.2	-	-	-

Node # 491	2049 AM Innovations					
Central Ave & 4th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	-	-	-	-	-	
EBR	-	-	-	-	-	
EB Approach	-	-	-	-	-	
WBL	B	11.1	0.00	0	375	
WBT	-	-	-	-	-	
WBR	A	6.8	0.08	30	375	
WB Approach	A	7.2	-	-	-	
NBL	-	-	-	-	-	
NBT	A	9.5	0.10	38	375	
NBR	-	-	-	-	-	
NB Approach	A	9.5	-	-	-	
SBL	-	-	-	-	-	
SBT	A	0.2	0.00	0	325	
SBR	-	-	-	-	-	
SB Approach	A	0.0	-	-	-	
Intersection	A	6.7	-	-	-	

Node # 491	2049 PM Innovations				
Central Ave & 4th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	A	5.8	0.00	0	375
WBT	-	-	-	-	-
WBR	A	8.6	0.14	53	375
WB Approach	A	8.6	-	-	-
NBL	-	-	-	-	-
NBT	B	15.3	0.20	75	375
NBR	-	-	-	-	-
NB Approach	B	15.3	-	-	-
SBL	-	-	-	-	-
SBT	A	9.7	0.08	26	325
SBR	-	-	-	-	-
SB Approach	A	9.7	-	-	-
Intersection	B	11.5	-	-	-

Node # 495	2049 AM Innovations					
Central Ave & 7th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	B	12.1	0.43	224	525	
EBT	A	8.8	0.43	224	525	
EBR	A	3.2	0.00	0	175	
EB Approach	A	7.1	-	-	-	
WBL	-	-	-	-	-	
WBT	-	-	-	-	-	
WBR	-	-	-	-	-	
WB Approach	-	-	-	-	-	
NBL	-	-	-	-	-	
NBT	D	43.9	0.36	105	290	
NBR	D	38.8	0.68	51	75	
NB Approach	D	45.3	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	-	-	-	-	-	
SB Approach	-	-	-	-	-	
Intersection	B	11.2	-	-	-	

Node # 495	2049 PM Innovations				
Central Ave & 7th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	B	17.4	0.35	186	525
EBT	B	14.4	0.35	186	525
EBR	A	2.7	0.00	0	175
EB Approach	B	13.5	-	-	-
WBL	-	-	-	-	-
WBT	-	-	-	-	-
WBR	-	-	-	-	-
WB Approach	-	-	-	-	-
NBL	-	-	-	-	-
NBT	B	10.4	0.14	40	290
NBR	A	2.5	0.00	0	75
NB Approach	A	8.8	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	B	12.6	-	-	-

Node # 497	2049 AM Innovations					
Central Ave & 9th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	-	-	-	-	-	
EBR	-	-	-	-	-	
EB Approach	-	-	-	-	-	
WBL	-	-	-	-	-	
WBT	A	9.6	0.07	23	340	
WBR	B	10.6	0.23	78	340	
WB Approach	B	10.9	-	-	-	
NBL	A	6.9	0.00	0	180	
NBT	B	13.2	0.31	56	180	
NBR	-	-	-	-	-	
NB Approach	B	12.6	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	A	5.4	0.00	0	240	
SB Approach	A	4.9	-	-	-	
Intersection	B	11.2	-	-	-	

Node # 497	2049 PM Innovations				
Central Ave & 9th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	-	-	-	-	-
WBT	B	18.6	0.31	107	340
WBR	C	23.6	0.57	194	340
WB Approach	C	20.5	-	-	-
NBL	B	12.1	0.00	0	180
NBT	C	23.8	0.27	49	180
NBR	-	-	-	-	-
NB Approach	C	20.6	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	A	10.0	0.07	17	240
SB Approach	A	10.0	-	-	-
Intersection	B	19.9	-	-	-

Node # 515	2049 AM Innovations					
Linn St & 8th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	C	33.8	0.38	104	270	
EBT	B	13.7	0.03	27	890	
EBR	A	0.0	0.00	0	120	
EB Approach	B	18.3	-	-	-	
WBL	D	44.4	0.12	55	470	
WBT	C	21.5	0.02	18	1075	
WBR	-	-	-	-	90	
WB Approach	C	21.8	-	-	-	
NBL	D	44.5	0.30	89	300	
NBT	C	28.7	0.01	9	640	
NBR	A	5.9	0.00	0	150	
NB Approach	C	31.2	-	-	-	
SBL	D	42.0	0.71	149	210	
SBT	C	24.0	0.01	5	790	
SBR	A	0.5	0.00	0	60	
SB Approach	C	30.3	-	-	-	
Intersection	C	23.2	-	-	-	

Node # 515	2049 PM Innovations				
Linn St & 8th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	E	73.7	0.74	199	270
EBT	B	14.9	0.03	22	890
EBR	A	0.0	0.00	0	120
EB Approach	D	37.8	-	-	-
WBL	D	47.5	0.05	21	470
WBT	B	17.2	0.02	18	1075
WBR	-	-	-	-	90
WB Approach	B	16.5	-	-	-
NBL	D	43.6	0.27	82	300
NBT	C	25.0	0.04	23	640
NBR	A	4.3	0.00	0	150
NB Approach	C	29.5	-	-	-
SBL	D	36.7	0.46	96	210
SBT	C	24.7	0.04	32	790
SBR	A	1.2	0.00	0	60
SB Approach	B	14.9	-	-	-
Intersection	C	24.6	-	-	-

Node # 517	2049 AM Innovations					
Western Ave & Gest St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	A	6.5	0.01	6	975	
EBR	-	-	-	-	-	
EB Approach	A	6.8	-	-	-	
WBL	-	-	-	-	-	
WBT	A	2.5	0.00	0	85	
WBR	-	-	-	-	-	
WB Approach	A	2.5	-	-	-	
NBL	-	-	-	-	-	
NBT	-	-	-	-	-	
NBR	-	-	-	-	-	
NB Approach	-	-	-	-	-	
SBL	C	33.0	0.09	93	1000	
SBT	-	-	-	-	-	
SBR	A	0.0	0.00	0	775	
SB Approach	B	18.8	-	-	-	
Intersection	B	11.1	-	-	-	

Node # 517	2049 PM Innovations				
Western Ave & Gest St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	A	8.5	0.02	16	975
EBR	-	-	-	-	-
EB Approach	A	8.5	-	-	-
WBL	-	-	-	-	-
WBT	B	15.6	0.13	11	85
WBR	-	-	-	-	-
WB Approach	B	15.6	-	-	-
NBL	-	-	-	-	-
NBT	-	-	-	-	-
NBR	-	-	-	-	-
NB Approach	-	-	-	-	-
SBL	C	26.3	0.08	84	1000
SBT	-	-	-	-	-
SBR	A	0.0	0.00	0	775
SB Approach	B	14.5	-	-	-
Intersection	B	13.1	-	-	-

Node # 520	2049 AM Innovations					
Freeman Ave & Gest St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	B	18.2	0.58	35	60	
EBT	B	11.1	0.45	27	60	
EBR	A	0.1	0.00	0	160	
EB Approach	B	11.2	-	-	-	
WBL	C	20.5	0.01	2	240	
WBT	C	22.1	0.29	73	250	
WBR	A	9.1	0.23	25	110	
WB Approach	B	17.5	-	-	-	
NBL	A	0.0	0.00	0	300	
NBT	C	22.6	0.15	123	800	
NBR	A	0.0	0.00	0	180	
NB Approach	C	21.6	-	-	-	
SBL	D	37.8	0.49	83	170	
SBT	B	15.6	0.15	105	720	
SBR	B	14.7	0.16	114	720	
SB Approach	B	18.9	-	-	-	
Intersection	B	17.7	-	-	-	

Node # 520	2049 PM Innovations				
Freeman Ave & Gest St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	B	10.6	0.33	20	60
EBT	C	20.9	1.17	70	60
EBR	A	0.6	0.00	0	160
EB Approach	B	15.6	-	-	-
WBL	C	34.0	0.07	16	240
WBT	C	29.3	0.25	61	250
WBR	B	11.6	0.56	62	110
WB Approach	C	20.1	-	-	-
NBL	A	0.0	0.00	0	300
NBT	C	21.7	0.12	92	800
NBR	A	0.0	0.00	0	180
NB Approach	C	21.7	-	-	-
SBL	D	42.4	0.36	61	170
SBT	B	15.9	0.10	72	720
SBR	B	15.8	0.10	76	720
SB Approach	B	19.6	-	-	-
Intersection	B	19.0	-	-	-

Node # 529	2049 AM Innovations					
Western Ave & Liberty St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	B	13.6	0.02	19	920	
EBR	A	9.7	0.03	25	920	
EB Approach	B	10.9	-	-	-	
WBL	A	4.9	0.00	0	170	
WBT	C	23.8	0.25	55	220	
WBR	-	-	-	-	-	
WB Approach	C	20.6	-	-	-	
NBL	-	-	-	-	-	
NBT	-	-	-	-	-	
NBR	-	-	-	-	-	
NB Approach	-	-	-	-	-	
SBL	B	10.1	0.10	16	155	
SBT	A	8.0	0.05	38	815	
SBR	A	7.0	0.03	25	815	
SB Approach	A	7.5	-	-	-	
Intersection	B	11.8	-	-	-	

Node # 529	2049 PM Innovations				
Western Ave & Liberty St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	B	13.0	0.03	27	920
EBR	A	9.4	0.02	18	920
EB Approach	B	11.7	-	-	-
WBL	A	6.5	0.09	16	170
WBT	B	17.4	0.15	33	220
WBR	-	-	-	-	-
WB Approach	B	12.8	-	-	-
NBL	-	-	-	-	-
NBT	-	-	-	-	-
NBR	-	-	-	-	-
NB Approach	-	-	-	-	-
SBL	B	11.9	0.25	39	155
SBT	A	9.9	0.08	62	815
SBR	A	8.1	0.04	35	815
SB Approach	B	10.4	-	-	-
Intersection	B	11.1	-	-	-

Node # 530	2049 AM Innovations					
Winchell Ave & Liberty St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	B	12.8	0.02	4	220	
EBT	A	6.3	0.11	25	220	
EBR	-	-	-	-	-	
EB Approach	A	6.0	-	-	-	
WBL	-	-	-	-	-	
WBT	B	12.1	0.07	19	260	
WBR	A	4.4	0.11	28	260	
WB Approach	A	5.5	-	-	-	
NBL	B	15.2	0.07	80	1130	
NBT	B	14.0	0.05	61	1130	
NBR	A	2.7	0.20	18	90	
NB Approach	A	8.4	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	-	-	-	-	-	
SB Approach	-	-	-	-	-	
Intersection	A	7.6	-	-	-	

Node # 530	2049 PM Innovations				
Winchell Ave & Liberty St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	B	15.9	0.07	16	220
EBT	A	8.1	0.23	50	220
EBR	-	-	-	-	-
EB Approach	A	9.0	-	-	-
WBL	-	-	-	-	-
WBT	B	12.1	0.16	40	260
WBR	A	4.9	0.15	40	260
WB Approach	A	6.9	-	-	-
NBL	B	14.1	0.05	56	1130
NBT	B	13.7	0.06	72	1130
NBR	A	2.9	0.26	23	90
NB Approach	A	9.3	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	A	8.5	-	-	-

Node # 531	2049 AM Innovations					
Winchell Ave & Findlay St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Stop
EBL	C	20.0	0.22	52	235	
EBT	A	8.9	0.01	3	235	
EBR	-	-	-	-	-	
EB Approach	C	16.5	-	-	-	
WBL	-	-	-	-	-	
WBT	A	8.5	0.07	17	250	
WBR	A	4.6	0.01	3	250	
WB Approach	A	7.5	-	-	-	
NBL	A	3.8	0.00	0	865	
NBT	C	19.5	0.09	77	840	
NBR	C	16.7	0.07	63	840	
NB Approach	C	16.4	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	-	-	-	-	-	
SB Approach	-	-	-	-	-	
Intersection	C	15.8	-	-	-	

Node # 531	2049 PM Innovations				
Winchell Ave & Findlay St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	C	23.4	0.41	97	235
EBT	C	16.0	0.05	11	235
EBR	-	-	-	-	-
EB Approach	C	21.7	-	-	-
WBL	-	-	-	-	-
WBT	A	8.8	0.07	17	250
WBR	A	6.0	0.07	18	250
WB Approach	A	7.2	-	-	-
NBL	A	4.7	0.00	0	865
NBT	C	19.9	0.10	86	840
NBR	C	17.7	0.09	74	840
NB Approach	C	18.2	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	C	17.2	-	-	-

Node # 534	2049 AM Innovations					
Western Ave & Findlay St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	B	13.6	0.04	16	370	
EBR	A	5.5	0.00	0	130	
EB Approach	A	8.2	-	-	-	
WBL	A	9.8	0.08	18	230	
WBT	A	4.5	0.00	0	230	
WBR	-	-	-	-	-	
WB Approach	A	7.8	-	-	-	
NBL	-	-	-	-	-	
NBT	-	-	-	-	-	
NBR	-	-	-	-	-	
NB Approach	-	-	-	-	-	
SBL	C	20.3	0.16	48	300	
SBT	C	20.6	0.18	88	490	
SBR	-	-	-	-	490	
SB Approach	B	17.0	-	-	-	
Intersection	B	15.4	-	-	-	

Node # 534	2049 PM Innovations				
Western Ave & Findlay St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	A	8.3	0.11	41	370
EBR	A	5.2	0.02	2	130
EB Approach	A	8.2	-	-	-
WBL	B	14.9	0.08	19	230
WBT	A	3.9	0.00	0	230
WBR	-	-	-	-	-
WB Approach	B	12.0	-	-	-
NBL	-	-	-	-	-
NBT	-	-	-	-	-
NBR	-	-	-	-	-
NB Approach	-	-	-	-	-
SBL	C	26.2	0.30	90	300
SBT	C	26.6	0.24	117	490
SBR	-	-	-	-	490
SB Approach	C	23.4	-	-	-
Intersection	B	18.4	-	-	-

Node # 539	2049 AM Innovations					
Spring Grove Ave & Bank St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	C	25.1	0.24	17	70	
EBT	B	18.1	0.38	50	130	
EBR	A	8.2	0.03	4	130	
EB Approach	B	16.6	-	-	-	
WBL	C	32.6	0.09	17	190	
WBT	B	18.6	0.25	48	190	
WBR	A	0.8	0.00	0	130	
WB Approach	A	9.5	-	-	-	
NBL	B	14.5	0.09	27	310	
NBT	A	2.8	0.00	0	420	
NBR	A	2.8	0.00	0	420	
NB Approach	A	6.1	-	-	-	
SBL	B	10.8	0.08	19	250	
SBT	A	4.9	0.02	22	1000	
SBR	A	3.8	0.02	23	1000	
SB Approach	A	5.3	-	-	-	
Intersection	A	8.0	-	-	-	

Node # 539	2049 PM Innovations				
Spring Grove Ave & Bank St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	B	14.0	0.13	9	70
EBT	B	12.0	0.67	87	130
EBR	A	5.9	0.00	0	130
EB Approach	B	11.3	-	-	-
WBL	C	34.7	0.24	46	190
WBT	B	17.8	0.18	34	190
WBR	A	0.1	0.00	0	130
WB Approach	A	8.7	-	-	-
NBL	D	51.1	0.38	119	310
NBT	B	14.6	0.13	55	420
NBR	B	13.2	0.19	78	420
NB Approach	C	21.8	-	-	-
SBL	C	20.4	0.24	60	250
SBT	A	9.8	0.05	52	1000
SBR	A	9.1	0.05	48	1000
SB Approach	B	11.8	-	-	-
Intersection	B	13.7	-	-	-

Node # 599	2049 AM Innovations					
NB Arterial & 9th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	-	-	-	-	-	
EBR	-	-	-	-	-	
EB Approach	-	-	-	-	-	
WBL	-	-	-	-	-	
WBT	A	5.5	0.11	17	150	
WBR	A	2.0	0.10	15	150	
WB Approach	A	2.7	-	-	-	
NBL	A	9.3	0.00	0	675	
NBT	A	9.3	0.00	0	675	
NBR	-	-	-	-	-	
NB Approach	B	14.3	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	-	-	-	-	-	
SB Approach	-	-	-	-	-	
Intersection	A	4.5	-	-	-	

Node # 599	2049 PM Innovations				
NB Arterial & 9th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	-	-	-	-	-
WBT	A	9.7	0.34	52	150
WBR	A	2.1	0.22	32	150
WB Approach	A	6.0	-	-	-
NBL	B	16.1	0.07	47	675
NBT	B	16.1	0.07	47	675
NBR	-	-	-	-	-
NB Approach	B	16.1	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	A	6.1	-	-	-

Node # 602	2049 AM Innovations					
NB Arterial & 7th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Signal
EBL	-	-	-	-	-	
EBT	D	38.6	0.11	113	1000	
EBR	-	-	-	-	-	
EB Approach	B	18.3	-	-	-	
WBL	-	-	-	-	-	
WBT	-	-	-	-	-	
WBR	-	-	-	-	-	
WB Approach	-	-	-	-	-	
NBL	-	-	-	-	-	
NBT	D	39.6	0.30	74	250	
NBR	-	-	-	-	-	
NB Approach	D	48.9	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	-	-	-	-	-	
SB Approach	-	-	-	-	-	
Intersection	D	38.7	-	-	-	

Node # 602	2049 PM Innovations				
NB Arterial & 7th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	A	9.1	0.07	67	1000
EBR	-	-	-	-	-
EB Approach	A	9.1	-	-	-
WBL	-	-	-	-	-
WBT	-	-	-	-	-
WBR	-	-	-	-	-
WB Approach	-	-	-	-	-
NBL	-	-	-	-	-
NBT	A	9.5	0.23	59	250
NBR	-	-	-	-	-
NB Approach	A	9.5	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	A	9.4	-	-	-

Node # 604	2049 AM Innovations					
SB I-75 & WHV	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	Stop
EBL	-	-	-	-	-	
EBT	-	-	-	-	-	
EBR	-	-	-	-	-	
EB Approach	-	-	-	-	-	
WBL	-	-	-	-	-	
WBT	A	3.6	0.12	27	220	
WBR	-	-	-	-	-	
WB Approach	A	3.7	-	-	-	
NBL	-	-	-	-	-	
NBT	-	-	-	-	-	
NBR	-	-	-	-	-	
NB Approach	-	-	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	A	5.0	0.02	29	1185	
SB Approach	A	4.8	-	-	-	
Intersection	A	4.1	-	-	-	

Node # 604	2049 PM Innovations				
SB I-75 & WHV	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	-	-	-	-	-
WBT	A	1.8	0.10	23	220
WBR	-	-	-	-	-
WB Approach	A	1.8	-	-	-
NBL	-	-	-	-	-
NBT	-	-	-	-	-
NBR	-	-	-	-	-
NB Approach	-	-	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	C	24.5	0.13	156	1185
SB Approach	C	24.5	-	-	-
Intersection	B	11.9	-	-	-

Node # 626	2049 AM Innovations				
US-42 & 3rd St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	E	65.5	0.13	36	270
EBT	E	60.9	0.06	73	1300
EBR	F	107.8	3.96	475	120
EB Approach	C	34.1	-	-	-
WBL	E	59.7	0.11	106	1010
WBT	D	54.7	0.16	166	1010
WBR	B	10.5	0.06	17	300
WB Approach	D	47.9	-	-	-
NBL	D	39.2	0.29	102	350
NBT	B	13.9	0.70	217	310
NBR	B	13.9	0.70	217	310
NB Approach	C	21.3	-	-	-
SBL	E	65.5	0.05	17	340
SBT	C	29.3	0.45	155	340
SBR	A	1.2	0.00	0	160
SB Approach	C	28.0	-	-	-
Intersection	D	42.1	-	-	-

Signal

Node # 626	2049 PM Innovations				
US-42 & 3rd St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	D	53.0	0.26	69	270
EBT	D	44.6	0.07	91	1300
EBR	C	20.1	1.53	184	120
EB Approach	C	25.5	-	-	-
WBL	F	81.5	0.28	286	1010
WBT	D	38.8	0.09	91	1010
WBR	B	15.5	0.31	92	300
WB Approach	E	60.8	-	-	-
NBL	D	43.0	0.37	129	350
NBT	D	41.3	0.99	307	310
NBR	D	41.3	0.99	307	310
NB Approach	D	42.0	-	-	-
SBL	D	49.7	0.02	7	340
SBT	D	45.7	0.27	92	340
SBR	A	6.5	0.00	0	160
SB Approach	D	43.4	-	-	-
Intersection	D	42.9	-	-	-

Node # 237	2049 AM Innovations				
5th St & Main St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	C	20.0	0.21	140	650
EBT	C	21.9	0.31	204	650
EBR	C	23.8	0.31	204	650
EB Approach	C	22.1	-	-	-
WBL	-	-	-	-	-
WBT	-	-	-	-	-
WBR	-	-	-	-	-
WB Approach	-	-	-	-	-
NBL	-	-	-	-	-
NBT	D	41.5	1.08	324	300
NBR	C	31.6	0.21	62	300
NB Approach	D	41.8	-	-	-
SBL	F	89.6	0.54	120	225
SBT	C	24.3	0.29	102	350
SBR	-	-	-	-	-
SB Approach	E	56.0	-	-	-
Intersection	C	32.3	-	-	-

Signal

Node # 237	2049 PM Innovations				
5th St & Main St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	C	20.5	0.17	110	650
EBT	C	24.5	0.31	199	650
EBR	C	28.5	0.31	199	650
EB Approach	C	24.9	-	-	-
WBL	-	-	-	-	-
WBT	-	-	-	-	-
WBR	-	-	-	-	-
WB Approach	-	-	-	-	-
NBL	-	-	-	-	-
NBT	D	38.3	0.61	182	300
NBR	B	12.9	0.13	38	300
NB Approach	C	31.1	-	-	-
SBL	D	48.4	0.70	157	225
SBT	A	7.0	0.28	98	350
SBR	-	-	-	-	-
SB Approach	C	22.1	-	-	-
Intersection	C	25.0	-	-	-

Node # 257	2049 AM Innovations				
Simon Kenton & 9th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	D	41.6	0.08	64	800
EBT	D	41.6	0.08	64	800
EBR	-	-	-	-	-
EB Approach	D	42.2	-	-	-
WBL	-	-	-	-	-
WBT	C	23.4	0.34	67	200
WBR	C	23.4	0.34	67	200
WB Approach	C	23.7	-	-	-
NBL	A	1.3	0.00	0	700
NBT	A	1.3	0.00	0	700
NBR	A	1.3	0.00	0	700
NB Approach	A	1.3	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	C	23.7	-	-	-

Signal

Node # 257	2049 PM Innovations				
Simon Kenton & 9th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	D	41.4	0.09	69	800
EBT	D	41.4	0.09	69	800
EBR	-	-	-	-	-
EB Approach	D	41.4	-	-	-
WBL	-	-	-	-	-
WBT	C	31.4	0.31	62	200
WBR	C	31.4	0.31	62	200
WB Approach	C	31.4	-	-	-
NBL	A	2.6	0.00	0	700
NBT	A	2.6	0.00	0	700
NBR	A	2.6	0.00	0	700
NB Approach	A	2.6	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	C	25.1	-	-	-

Node # 258	2049 AM Innovations				
Simon Kenton Way & 12th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	B	11.1	0.20	42	210
EBT	A	8.5	0.37	77	210
EBR	-	-	-	-	-
EB Approach	A	8.5	-	-	-
WBL	-	-	-	-	-
WBT	D	39.5	0.31	181	575
WBR	B	12.0	0.13	76	575
WB Approach	C	24.2	-	-	-
NBL	C	32.1	0.04	41	950
NBT	C	33.9	0.07	66	950
NBR	A	7.3	0.09	36	395
NB Approach	C	20.0	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	B	17.7	-	-	-

Signal

Node # 258	2049 PM Innovations				
Simon Kenton Way & 12th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	C	21.2	0.11	23	210
EBT	B	13.0	0.41	87	210
EBR	-	-	-	-	-
EB Approach	B	13.8	-	-	-
WBL	-	-	-	-	-
WBT	D	47.9	0.46	262	575
WBR	B	13.9	0.18	102	575
WB Approach	C	29.5	-	-	-
NBL	C	28.9	0.06	60	950
NBT	C	34.4	0.11	105	950
NBR	A	9.6	0.19	76	395
NB Approach	B	19.6	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	C	23.0	-	-	-

Node # 263	2049 AM Innovations				
4th St & Main St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	B	15.4	0.20	75	381
WBT	B	14.3	0.14	54	381
WBR	A	0.0	-	0	0
WB Approach	C	21.2	-	-	-
NBL	D	42.6	0.28	100	350
NBT	B	19.9	0.56	195	350
NBR	-	-	-	-	-
NB Approach	C	23.3	-	-	-
SBL	-	-	-	-	-
SBT	C	32.8	0.10	84	856
SBR	A	8.2	0.04	38	856
SB Approach	B	17.1	-	-	-
Intersection	B	12.3	-	-	-

Signal

Node # 263	2049 PM Innovations				
4th St & Main St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	B	12.9	0.32	120	381
WBT	A	9.5	0.31	117	381
WBR	A	0.0	-	0	0
WB Approach	C	25.5	-	-	-
NBL	F	90.6	0.29	100	350
NBT	A	0.0	0.00	0	350
NBR	-	-	-	-	-
NB Approach	B	18.5	-	-	-
SBL	-	-	-	-	-
SBT	C	23.8	0.26	224	856
SBR	C	24.8	0.24	209	856
SB Approach	C	24.7	-	-	-
Intersection	B	14.8	-	-	-

Node # 285	2049 AM Innovations				
Bullock St & 12th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	B	17.8	0.20	110	565
EBR	B	17.8	0.20	110	565
EB Approach	B	19.8	-	-	-
WBL	B	17.7	0.37	80	215
WBT	A	0.5	0.01	3	215
WBR	-	-	-	-	-
WB Approach	B	15.4	-	-	-
NBL	-	-	-	-	-
NBT	-	-	-	-	-
NBR	-	-	-	-	-
NB Approach	-	-	-	-	-
SBL	D	40.0	0.45	209	465
SBT	D	35.1	0.26	120	465
SBR	C	34.4	0.26	123	465
SB Approach	D	37.1	-	-	-
Intersection	C	26.7	-	-	-

Signal

Node # 285	2049 PM Innovations				
Bullock St & 12th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	C	23.9	0.24	134	565
EBR	C	23.9	0.24	134	565
EB Approach	C	23.9	-	-	-
WBL	B	11.9	0.41	88	215
WBT	A	0.4	0.00	0	215
WBR	-	-	-	-	-
WB Approach	B	10.5	-	-	-
NBL	-	-	-	-	-
NBT	-	-	-	-	-
NBR	-	-	-	-	-
NB Approach	-	-	-	-	-
SBL	C	27.7	0.42	195	465
SBT	D	41.9	0.48	225	465
SBR	D	42.0	0.48	223	465
SB Approach	D	37.9	-	-	-
Intersection	C	28.2	-	-	-

Node # 301	2049 AM Innovations				
Dixie Hwy & Kyles Lane	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	C	30.7	0.42	154	370
EBR	B	17.3	0.54	84	156
EB Approach	C	27.2	-	-	-
WBL	C	23.6	0.50	145	289
WBT	A	6.5	0.06	35	625
WBR	-	-	-	-	-
WB Approach	B	13.8	-	-	-
NBL	B	19.5	0.07	41	550
NBT	-	-	-	-	-
NBR	A	5.5	0.07	41	550
NB Approach	A	8.6	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	B	18.1	-	-	-

Signal

Node # 301	2049 PM Innovations				
Dixie Hwy & Kyles Lane	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	C	25.3	0.28	104	370
EBR	B	10.5	0.30	48	156
EB Approach	C	20.6	-	-	-
WBL	C	26.8	0.66	189	289
WBT	A	8.5	0.14	88	625
WBR	-	-	-	-	-
WB Approach	B	14.3	-	-	-
NBL	B	17.0	0.09	47	550
NBT	-	-	-	-	-
NBR	A	5.2	0.08	44	550
NB Approach	A	9.0	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	B	14.5	-	-	-

Node # 316 Philadelphia St & 9th St	2049 AM Innovations					Stop
	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	
EBL	-	-	-	-	-	
EBT	A	0.0	-	0	-	
EBR	-	-	-	-	-	
EB Approach	A	0.0	-	-	-	
WBL	-	-	-	-	-	
WBT	A	0.2	-	0	-	
WBR	-	-	-	-	-	
WB Approach	A	0.3	-	-	-	
NBL	-	-	-	-	-	
NBT	-	-	-	-	-	
NBR	-	-	-	-	-	
NB Approach	-	-	-	-	-	
SBL	A	4.8	0.00	2	525	
SBT	-	-	-	-	-	
SBR	A	4.8	0.00	2	525	
SB Approach	A	4.8	-	-	-	
Intersection	A	1.5	-	-	-	

Node # 316 Philadelphia St & 9th St	2049 PM Innovations				
	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	A	0.0	-	0	-
EBR	-	-	-	-	-
EB Approach	A	0.0	-	-	-
WBL	-	-	-	-	-
WBT	A	0.2	-	0	-
WBR	-	-	-	-	-
WB Approach	A	0.2	-	-	-
NBL	-	-	-	-	-
NBT	-	-	-	-	-
NBR	-	-	-	-	-
NB Approach	-	-	-	-	-
SBL	A	5.0	0.03	16	525
SBT	-	-	-	-	-
SBR	A	5.0	0.03	16	525
SB Approach	A	5.0	-	-	-
Intersection	A	2.3	-	-	-

Node # 317 Main St & Pike St	2049 AM Innovations					Signal
	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	
EBL	C	31.9	0.22	201	905	
EBT	A	7.8	0.07	67	905	
EBR	-	-	-	-	-	
EB Approach	C	20.5	-	-	-	
WBL	-	-	-	-	-	
WBT	C	25.3	0.16	140	875	
WBR	C	25.3	0.16	140	875	
WB Approach	C	24.3	-	-	-	
NBL	-	-	-	-	-	
NBT	-	-	-	-	-	
NBR	-	-	-	-	-	
NB Approach	-	-	-	-	-	
SBL	A	8.4	0.08	38	475	
SBT	-	-	-	-	-	
SBR	A	8.4	0.08	38	475	
SB Approach	A	9.4	-	-	-	
Intersection	C	21.1	-	-	-	

Node # 317 Main St & Pike St	2049 PM Innovations				
	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	B	17.7	0.08	72	905
EBT	A	7.3	0.06	51	905
EBR	-	-	-	-	-
EB Approach	B	11.2	-	-	-
WBL	-	-	-	-	-
WBT	C	23.2	0.15	132	875
WBR	C	23.2	0.15	132	875
WB Approach	C	23.2	-	-	-
NBL	-	-	-	-	-
NBT	-	-	-	-	-
NBR	-	-	-	-	-
NB Approach	-	-	-	-	-
SBL	A	9.4	0.16	75	475
SBT	-	-	-	-	-
SBR	A	9.4	0.16	75	475
SB Approach	A	9.4	-	-	-
Intersection	B	14.0	-	-	-

Node # 486 Philadelphia St & 3rd St	2049 AM Innovations					Signal
	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	
EBL	C	34.7	0.21	245	1175	
EBT	C	34.7	0.21	245	1175	
EBR	C	27.0	0.21	248	1175	
EB Approach	C	34.2	-	-	-	
WBL	D	39.5	0.10	26	250	
WBT	A	2.5	0.00	3	1110	
WBR	A	2.5	0.00	3	1110	
WB Approach	B	12.5	-	-	-	
NBL	D	36.1	0.46	160	350	
NBT	D	36.1	0.46	160	350	
NBR	-	-	-	-	350	
NB Approach	C	28.2	-	-	-	
SBL	C	26.3	0.09	18	200	
SBT	B	14.8	0.09	18	200	
SBR	A	3.3	0.00	0	200	
SB Approach	B	18.0	-	-	-	
Intersection	C	27.0	-	-	-	

Node # 486 Philadelphia St & 3rd St	2049 PM Innovations				
	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	E	56.7	0.23	270	1175
EBT	E	56.7	0.23	270	1175
EBR	A	7.8	0.05	64	1175
EB Approach	C	33.3	-	-	-
WBL	C	26.0	0.15	39	250
WBT	C	22.8	0.08	94	1110
WBR	C	22.8	0.08	94	1110
WB Approach	C	23.6	-	-	-
NBL	B	13.3	0.41	143	350
NBT	B	13.3	0.41	143	350
NBR	-	-	-	-	350
NB Approach	B	13.0	-	-	-
SBL	B	15.4	0.09	17	200
SBT	B	10.6	0.09	17	200
SBR	A	5.7	0.01	1	200
SB Approach	B	11.0	-	-	-
Intersection	C	24.0	-	-	-

Node # 548 Philadelphia & 5th St	2049 AM Innovations					Signal
	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	
EBL	B	18.5	0.45	223	500	
EBT	B	17.9	0.45	223	500	
EBR	B	17.2	0.42	208	500	
EB Approach	B	17.3	-	-	-	
WBL	-	-	-	-	-	
WBT	-	-	-	-	-	
WBR	-	-	-	-	-	
WB Approach	-	-	-	-	-	
NBL	-	-	-	-	-	
NBT	D	46.0	0.41	132	325	
NBR	D	46.0	0.41	132	325	
NB Approach	D	44.6	-	-	-	
SBL	C	27.0	0.11	20	173	
SBT	E	62.3	0.24	83	350	
SBR	-	-	-	-	-	
SB Approach	D	49.6	-	-	-	
Intersection	C	23.0	-	-	-	

Node # 548 Philadelphia & 5th St	2049 PM Innovations				
	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	B	13.5	0.28	142	500
EBT	B	13.0	0.29	145	500
EBR	B	12.5	0.29	145	500
EB Approach	B	13.2	-	-	-
WBL	-	-	-	-	-
WBT	-	-	-	-	-
WBR	-	-	-	-	-
WB Approach	-	-	-	-	-
NBL	-	-	-	-	-
NBT	D	43.8	0.46	149	325
NBR	D	43.8	0.46	149	325
NB Approach	D	43.8	-	-	-
SBL	D	45.8	0.30	52	173
SBT	E	56.5	0.17	60	350
SBR	-	-	-	-	-
SB Approach	D	50.9	-	-	-
Intersection	C	21.4	-	-	-

Node # 549 Philadelphia & 4th St	2049 AM Innovations					Signal
	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	
EBL	-	-	-	-	-	
EBT	-	-	-	-	-	
EBR	-	-	-	-	-	
EB Approach	-	-	-	-	-	
WBL	C	23.7	0.31	93	300	
WBT	C	21.7	0.22	65	300	
WBR	D	43.5	0.83	249	300	
WB Approach	C	32.8	-	-	-	
NBL	E	60.4	1.29	219	169	
NBT	C	22.6	0.23	82	350	
NBR	-	-	-	-	-	
NB Approach	D	47.8	-	-	-	
SBL	-	-	-	-	-	
SBT	C	24.6	0.20	65	325	
SBR	D	44.4	0.89	288	325	
SB Approach	D	43.1	-	-	-	
Intersection	D	38.4	-	-	-	

Node # 549 Philadelphia & 4th St	2049 PM Innovations				
	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	B	17.1	0.74	222	300
WBT	B	19.5	0.43	129	300
WBR	B	12.8	0.64	191	300
WB Approach	B	15.6	-	-	-
NBL	C	24.3	0.71	119	169
NBT	D	38.6	0.36	126	350
NBR	-	-	-	-	-
NB Approach	C	29.3	-	-	-
SBL	-	-	-	-	-
SBT	D	44.6	0.22	72	325
SBR	C	25.6	0.42	137	325
SB Approach	C	31.0	-	-	-
Intersection	C	20.8	-	-	-

Node # 554 Crescent & 4th St	2049 AM Innovations					Stop
	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	
EBL	-	-	-	-	-	
EBT	-	-	-	-	-	
EBR	-	-	-	-	-	
EB Approach	-	-	-	-	-	
WBL	A	7.1	0.05	16	325	
WBT	-	-	-	-	-	
WBR	-	-	-	-	-	
WB Approach	A	7.0	-	-	-	
NBL	-	-	-	-	-	
NBT	A	0.0	0.00	0	610	
NBR	A	0.0	0.00	0	270	
NB Approach	A	0.0	-	-	-	
SBL	A	0.2	0.00	0	290	
SBT	A	0.0	0.00	0	530	
SBR	-	-	-	-	-	
SB Approach	A	0.3	-	-	-	
Intersection	A	1.5	-	-	-	

Node # 554 Crescent & 4th St	2049 PM Innovations				
	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	B	11.8	0.13	43	325
WBT	-	-	-	-	-
WBR	-	-	-	-	-
WB Approach	B	11.8	-	-	-
NBL	-	-	-	-	-
NBT	A	0.0	0.00	0	610
NBR	A	0.0	0.00	0	270
NB Approach	A	0.0	-	-	-
SBL	A	0.3	0.00	0	290
SBT	A	0.0	0.00	0	530
SBR	-	-	-	-	-
SB Approach	A	0.2	-	-	-
Intersection	A	3.6	-	-	-

Node # 559	2049 AM Innovations					Signal
Johnson St & 4th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	
EBL	-	-	-	-	-	
EBT	-	-	-	-	-	
EBR	-	-	-	-	-	
EB Approach	-	-	-	-	-	
WBL	B	13.9	0.18	73	415	
WBT	B	13.9	0.12	49	415	
WBR	B	19.4	0.51	211	415	
WB Approach	C	21.2	-	-	-	
NBL	D	38.3	0.13	53	415	
NBT	D	38.3	0.13	53	415	
NBR	-	-	-	-	-	
NB Approach	D	37.8	-	-	-	
SBL	-	-	-	-	-	
SBT	B	18.7	0.37	102	275	
SBR	B	15.1	0.32	88	275	
SB Approach	B	16.1	-	-	-	
Intersection	B	18.2	-	-	-	

Node # 559	2049 PM Innovations				
Johnson St & 4th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	-	-	-	-	-
EBR	-	-	-	-	-
EB Approach	-	-	-	-	-
WBL	B	19.7	0.38	156	415
WBT	B	19.4	0.34	140	415
WBR	B	19.5	0.45	186	415
WB Approach	C	25.5	-	-	-
NBL	C	26.8	0.11	44	415
NBT	C	26.8	0.11	44	415
NBR	-	-	-	-	-
NB Approach	C	26.8	-	-	-
SBL	-	-	-	-	-
SBT	B	17.2	0.50	138	275
SBR	B	12.0	0.27	74	275
SB Approach	B	14.3	-	-	-
Intersection	B	18.2	-	-	-

Node # 561	2049 AM Innovations					Signal
Simon Kenton Way & Pike St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	
EBL	A	9.3	0.25	61	246	
EBT	A	3.5	0.30	73	246	
EBR	-	-	-	-	-	
EB Approach	A	6.7	-	-	-	
WBL	-	-	-	-	-	
WBT	C	34.2	0.12	101	860	
WBR	C	33.1	0.22	185	860	
WB Approach	C	34.2	-	-	-	
NBL	C	29.1	0.31	131	423	
NBT	C	30.7	0.29	121	423	
NBR	A	9.6	0.08	32	423	
NB Approach	C	25.1	-	-	-	
SBL	-	-	-	-	-	
SBT	-	-	-	-	-	
SBR	-	-	-	-	-	
SB Approach	-	-	-	-	-	
Intersection	B	16.5	-	-	-	

Node # 561	2049 PM Innovations				
Simon Kenton Way & Pike St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	F	87.7	0.74	183	246
EBT	B	14.2	0.51	124	246
EBR	-	-	-	-	-
EB Approach	D	54.9	-	-	-
WBL	-	-	-	-	-
WBT	C	27.3	0.13	113	860
WBR	C	31.8	0.29	247	860
WB Approach	C	30.6	-	-	-
NBL	C	29.0	0.40	168	423
NBT	C	27.5	0.37	156	423
NBR	A	0.0	0.00	0	423
NB Approach	C	25.1	-	-	-
SBL	-	-	-	-	-
SBT	-	-	-	-	-
SBR	-	-	-	-	-
SB Approach	-	-	-	-	-
Intersection	D	35.7	-	-	-

Node # 562	2049 AM Innovations					Signal
Bullock St & Pike St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	
EBL	-	-	-	-	-	
EBT	C	25.1	0.28	269	960	
EBR	B	17.9	0.17	158	960	
EB Approach	C	21.5	-	-	-	
WBL	E	67.0	0.57	142	248	
WBT	A	4.1	0.13	33	248	
WBR	-	-	-	-	-	
WB Approach	C	29.5	-	-	-	
NBL	-	-	-	-	-	
NBT	-	-	-	-	-	
NBR	-	-	-	-	-	
NB Approach	-	-	-	-	-	
SBL	D	41.1	0.41	217	530	
SBT	C	28.9	0.15	158	1075	
SBR	A	5.7	0.03	28	1075	
SB Approach	C	27.4	-	-	-	
Intersection	C	26.4	-	-	-	

Node # 562	2049 PM Innovations				
Bullock St & Pike St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	-	-	-	-	-
EBT	D	41.7	0.23	221	960
EBR	C	30.2	0.06	58	960
EB Approach	D	39.1	-	-	-
WBL	A	6.4	0.08	20	248
WBT	B	13.2	0.60	148	248
WBR	-	-	-	-	-
WB Approach	B	11.2	-	-	-
NBL	-	-	-	-	-
NBT	-	-	-	-	-
NBR	-	-	-	-	-
NB Approach	-	-	-	-	-
SBL	D	35.5	0.48	256	530
SBT	D	53.4	0.41	439	1075
SBR	D	42.5	0.32	348	1075
SB Approach	D	44.0	-	-	-
Intersection	D	35.6	-	-	-

Node # 603	2049 AM Innovations					Signal
Johnson St & 5th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	
EBL	C	20.3	0.56	219	390	
EBT	C	21.6	0.66	257	390	
EBR	C	22.9	0.66	257	390	
EB Approach	C	21.5	-	-	-	
WBL	-	-	-	-	-	
WBT	-	-	-	-	-	
WBR	-	-	-	-	-	
WB Approach	-	-	-	-	-	
NBL	-	-	-	-	-	
NBT	B	15.0	0.06	17	280	
NBR	B	15.0	0.06	17	280	
NB Approach	B	19.0	-	-	-	
SBL	B	12.9	0.09	32	360	
SBT	B	12.9	0.09	32	360	
SBR	-	-	-	-	-	
SB Approach	B	12.9	-	-	-	
Intersection	C	20.7	-	-	-	

Node # 603	2049 PM Innovations				
Johnson St & 5th St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	C	22.2	0.39	151	390
EBT	C	21.3	0.39	151	390
EBR	C	20.3	0.38	147	390
EB Approach	C	21.1	-	-	-
WBL	-	-	-	-	-
WBT	-	-	-	-	-
WBR	-	-	-	-	-
WB Approach	-	-	-	-	-
NBL	-	-	-	-	-
NBT	A	9.3	0.06	17	280
NBR	A	9.3	0.06	17	280
NB Approach	A	9.3	-	-	-
SBL	A	8.5	0.12	42	360
SBT	A	8.5	0.12	42	360
SBR	-	-	-	-	-
SB Approach	A	8.5	-	-	-
Intersection	B	18.1	-	-	-

Node # 612	2049 AM Innovations					Signal
Johnson St & 3rd St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)	
EBL	A	6.8	0.03	22	825	
EBT	C	20.1	0.09	76	825	
EBR	C	20.1	0.09	76	825	
EB Approach	B	11.0	-	-	-	
WBL	B	19.1	0.20	58	290	
WBT	A	5.2	0.01	16	1400	
WBR	A	5.2	0.01	16	1400	
WB Approach	B	14.3	-	-	-	
NBL	D	45.4	0.07	20	290	
NBT	B	11.3	0.06	17	290	
NBR	B	11.3	0.06	17	290	
NB Approach	B	13.3	-	-	-	
SBL	C	21.9	0.05	17	305	
SBT	C	23.9	0.38	116	305	
SBR	C	25.9	0.38	116	305	
SB Approach	C	25.3	-	-	-	
Intersection	B	15.8	-	-	-	

Node # 612	2049 PM Innovations				
Johnson St & 3rd St	LOS	Delay (sec/veh)	QSR	95th %ile Queue (ft)	Storage Length (ft)
EBL	D	35.8	0.20	169	825
EBT	C	23.6	0.15	126	825
EBR	C	23.6	0.15	126	825
EB Approach	C	29.1	-	-	-
WBL	C	32.1	0.31	90	290
WBT	B	14.7	0.04	54	1400
WBR	B	14.7	0.04	54	1400
WB Approach	C	24.3	-	-	-
NBL	C	30.8	0.20	58	290
NBT	B	12.3	0.07	20	290
NBR	B	12.3	0.07	20	290
NB Approach	B	15.6	-	-	-
SBL	B	15.9	0.09	26	305
SBT	B	18.0	0.43	131	305
SBR	C	20.1	0.43	131	305
SB Approach	B	19.3	-	-	-
Intersection	C	24.0	-	-	-

Appendix G:
IMS Addendum Safety Analysis

BRENT SPENCE BRIDGE CORRIDOR PROJECT

BUILD INNOVATIONS SAFETY ANALYSIS

ODOT PID 116649 | KYTC PROJECT ITEM NO. 6-17
AUGUST 22, 2025

HNTB

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1. INTRODUCTION

This Interchange Modification Study (IMS) addendum safety analysis aims to review existing safety conditions and assess the effectiveness of the Build Innovations alternative to address the corridor's safety deficiencies. The Build Innovations alternative includes design enhancements to the previously preferred alternative referred to as Refined Alternative I (Concept I-W). The IMS for the Refined Alternative I (Concept I-W) was approved by the Federal Highway Administration (FHWA) in 2023.

The addendum will assist the Kentucky Transportation Cabinet (KYTC), the Ohio Department of Transportation (ODOT), and FHWA in assessing the differences in safety impacts between Build Innovations and Refined Alternative I (Concept I-W). The safety analysis in this memorandum provides the justification and documentation necessary to substantiate that the refinements incorporated into Build Innovations will maintain an acceptable level of safety for the study corridor.

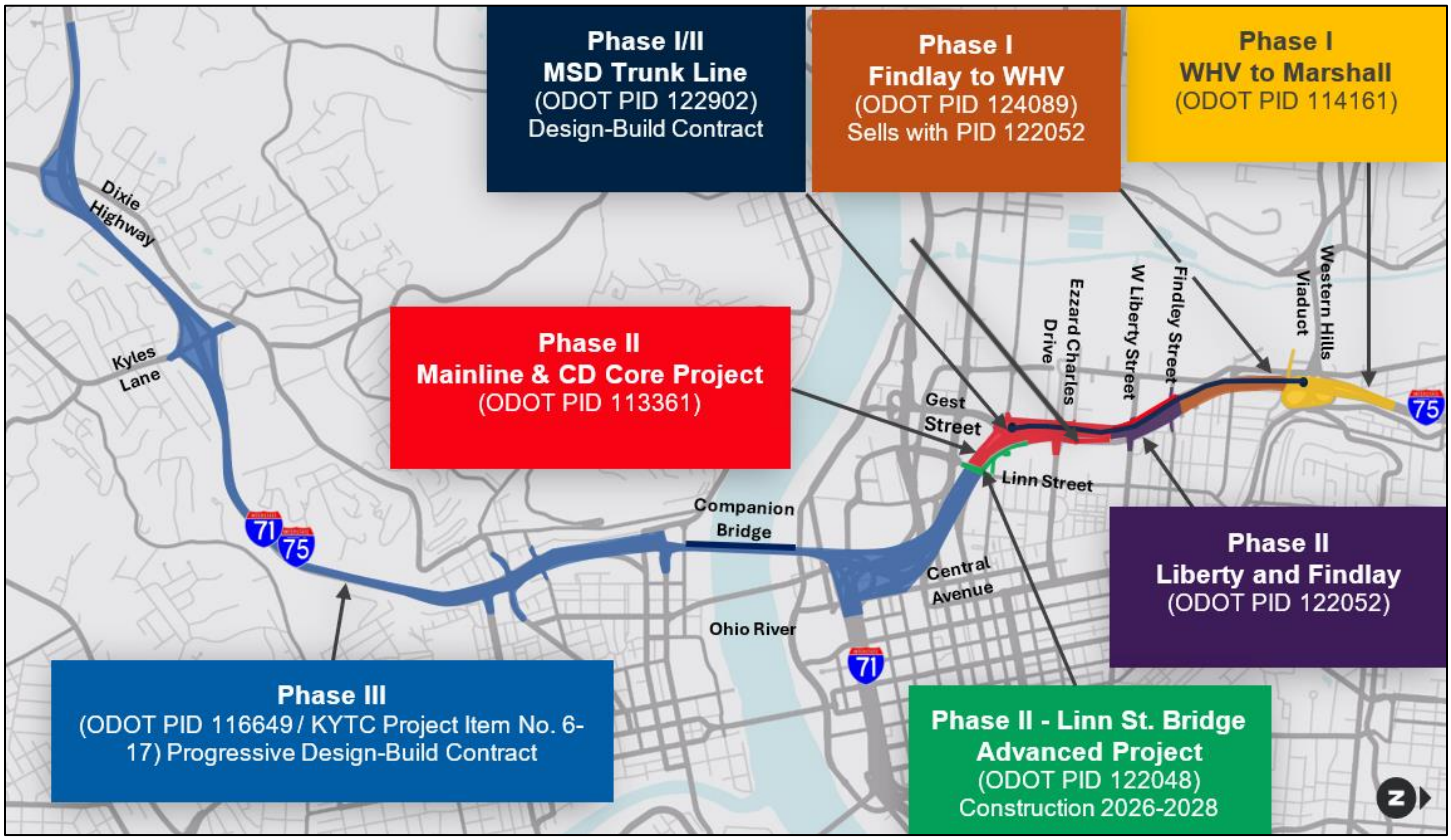
The IMS addendum safety analysis includes an updated historical crash analysis for 2019 to 2023, including the complete IMS study limits with all three phases of the Brent Spence Bridge corridor. Build Innovations only changes the design within Phase III of the project corridor, with minor volume changes in Phase II and nominal traffic changes in Phase I. Therefore, a comprehensive predictive safety analysis is performed to compare the safety impacts of the design changes incorporated into Build Innovations, focusing on the study limits within the Phase III and II project limits. This predictive analysis quantifies the safety impacts of the design changes and substantiates the acceptance of Build Innovations.

2. SAFETY ANALYSIS STUDY AREA

The BSB project area with the project phases identified is presented in **Figure 1.** This limit incorporates the I-71 and I-75 corridors, the BSB bridge crossing, a portion of US 50 West, US 50 East (along I-71, east of I-75), and adjacent ramp terminal and arterial intersections. The southern limit of the project corridor is south of the Dixie Highway interchange on I-71/I-75 in Fort Mitchell at Kentucky milepost 186.7. The northern limit of the project corridor is approximately 1,500 feet north of the Western Hills Viaduct (WHV) Interchange on I-75 in Cincinnati at Ohio milepost 2.5. The eastern and western limits of the project corridor follow the existing alignment of I-75, a major throughway for local and regional mobility within the Greater Cincinnati/Northern Kentucky region. Locally, I-75 connects to I-71, I-74, I-275, and US Route 50. The BSB provides an interstate connection carrying I-71 and I-75 over the Ohio River, providing a critical link along the national I-75 corridor stretching from Florida to Michigan.

The safety analysis covers the full BSB corridor limits. The proposed design changes for Build Innovation only impact the Phase III design, which extends from Dixie Hwy in Kentucky to Linn Street in Ohio. The safety analysis has two parts: a historical crash analysis that uses the latest 5-years of crash data (2019 – 2023) and a predictive crash analysis using the Interactive Highway Safety Design Module (IHSDM) that evaluates the predictive safety of Phase III and II construction limits and adjacent intersection as included in the IMS study limits. Phase I is not included in the predictive analysis as there are no design changes and only nominal volume differences.

Figure 1: BSB Project Limits



3. PROJECT BACKGROUND

On October 14, 2004, KYTC and ODOT recognized the need to improve the BSB corridor. They formally agreed to jointly develop and deliver a project to replace the existing BSB over the Ohio River. Key characteristics of the BSB corridor are described below:

- The corridor consists of 7.8 miles of I-71 and I-75, located within portions of Ohio and Kentucky.
- The BSB carries both I-71 and I-75 over the Ohio River.
- The BSB opened in 1963 and was initially designed to carry 80,000 vehicles per day (VPD) with current traffic volumes of 160,000 VPD.

3.1 Existing Conditions

The design of the I-71 and I-75 facilities at many locations within the project corridor do not meet current design standards for numerous features, including lane widths, shoulder widths, horizontal and vertical clearances, left-hand entrances and exits, and horizontal and vertical geometry. The operational design of the BSB, with its reduced travel lane and shoulder widths, is the most frequently noted substandard feature. The

BSB was opened in 1963 as a double-deck truss structure designed to carry three 12-foot travel lanes in both directions over the Ohio River. In 1985, increased traffic volumes resulted in the bridge needing to accommodate an additional travel lane in each direction to add capacity. To accomplish this, the original safety curb on the bridge was retrofitted to the New Jersey Barrier style barrier, and the existing travel lanes were reduced in width to accommodate four 11-foot lanes with one-foot shoulders.

In summary, the bridge was not designed to accommodate the current or future daily traffic volume. In addition to the design deficiencies on the bridge, the approaches on either side are also characterized by design deficiencies, such as narrow travel lanes and reduced shoulder widths. For these reasons, the BSB corridor experiences design deficiency and congestion-related crashes.

3.2 Purpose and Need

The purpose of the BSB Corridor Project is unchanged from what was presented in the approved May 2024 SEA/FONSI:

- Improve traffic flow and level of service.
- Improve safety.
- Correct geometric deficiencies.
- Maintain connections to critical regional and national transportation corridors.

4. SAFETY ANALYSIS METHODOLOGY

ODOT and KYTC have guidance for data-driven safety analysis that evaluates the safety benefit of a project. The two states have a similar process for the evaluation of safety on roadway projects, and both follow these general steps:

1) Identify locations with existing safety deficiencies
    a. ODOT uses the Safety Integrated Project Mapping with locations assigned a safety priority ranking.
    b. KYTC uses the Level of Service of Safety (LOSS) measurements to identify roadway segments with safety deficiencies and focuses its analysis on segments with LOSS 3 or 4 rankings.
2) Evaluate historical crashes
    a. Both states maintain a crash database that can be summarized to determine existing crash trends for individual roadway segments.
3) Predictive crash analysis to evaluate mitigation strategies
    a. ODOT uses the Economical Crash Analysis Tool (ECAT) for predictive crash analysis based on HSM procedures
    b. KYTC uses the HSM procedure and utilizes all available tools, including HSM spreadsheets, ISATe, and IHSDM.

The BSB project follows both states' guidelines with a unified methodology considering the abovementioned three main steps. The safety analysis for the BSB corridor includes the following:

1) KYTC and ODOT HSIP Priority segments are reviewed and documented in this report
2) Historical crash analysis evaluates the latest 5 years of crash data for the entire study limits consistent with IMS requirements.
3) Using IHSDM, HSM predictive safety analysis is completed for the study limits impacted by design changes to Build Innovations. This includes the project limits in Phases II and III. The summaries for the predictive analysis report crash frequencies and crash costs for each of the design comparisons.

The following sections provide a detailed step-by-step comparison of the BSB analysis approach related to the ODOT and KYTC processes.

4.1 BSB Project Application of KYTC Safety Process

KYTC has three safety analysis approaches based on the type of project and the severity of the existing crash trends. The categories include:

- Safety Analysis 1 (SA1)
    - Safety is not included in the purpose and need
    - Does not include multiple alternatives or multiple improvement options
- Safety Analysis 2 (SA2)
    - Includes Alternative analysis
    - Has multiple improvement options
- Safety Analysis 3 (SA3)
    - Any project with a high number of excessive crashes and will find a significant use for a cost/benefit analysis. Excessive crashes is the difference between predicted crashes and expected crashes. Expected crashes accounts for a segments crash history.

KYTC includes a flow chart for determining the safety analysis approach best suited for the project shown in **Figure 2.** The BSB project is identified as a project with safety in the initial purpose and need and has segments with LOSS 3 and 4. The project will not include a 20-year cost/benefit analysis of safety performance but does include crash costs for the alternative comparison. Therefore, the BSB project is categorized as an SA2, as highlighted by the hatched arrows in **Figure 2.** As prescribed by the SA2, the BSB project uses predictive safety analysis to evaluate the benefits of enhanced design for Build Innovations.

Figure 2: KYTC Safety Process

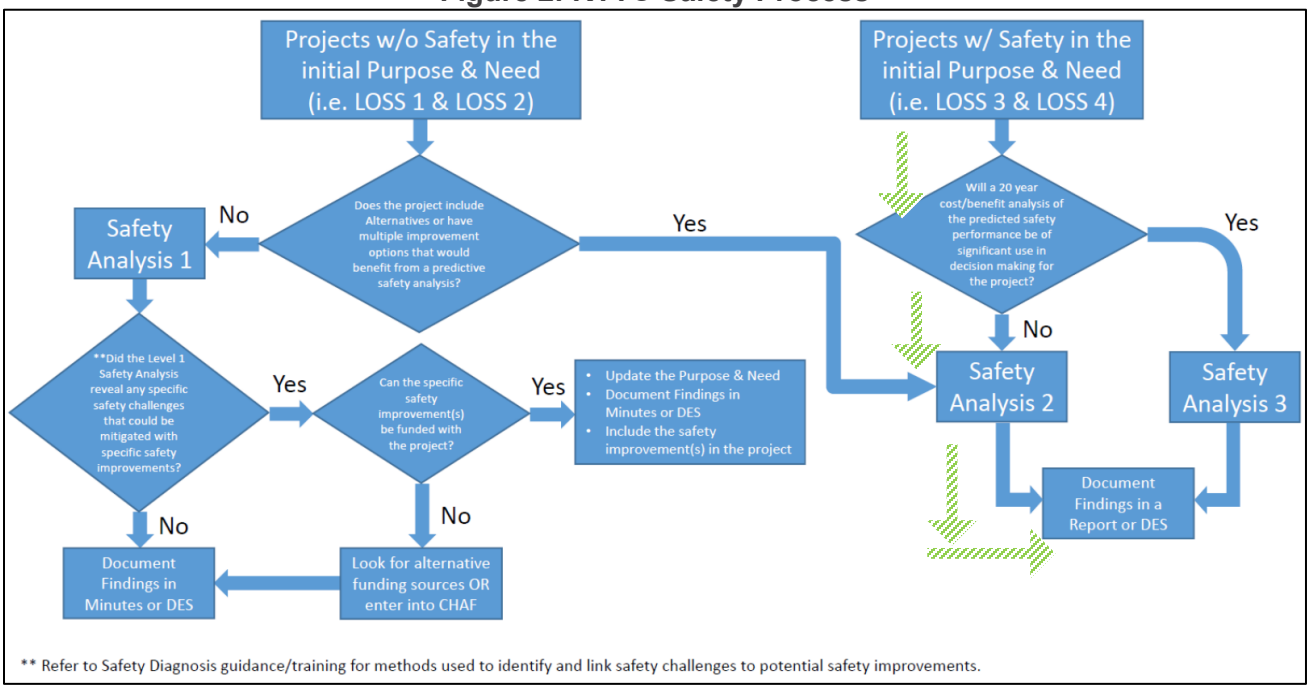


Chart Source: KYTC Safety Process

4.2 BSB Project Application of ODOT Safety Process

ODOT uses a data-driven safety analysis process and has methodologies based on the type of project and severity of existing crash trends. ODOT has three project categories:

1) Non-Complex Projects (No Alternative Analysis)
2) Complex Projects Assessment with Alternative Analysis without “Safety” in the Purpose and Need Statement
3) Complex Projects Assessment with Alternative Analysis and Safety Component

The BSB project is identified under the third category: “Complex Projects Assessment with Alternative Analysis and Safety Component.” This category is for projects with “Safety” considerations in the purpose and need and for projects with intended safety funding requests. The safety methodology flow chart is shown in **Figure 3**. The BSB project follows the green-hatched arrows through the flow chart.

Figure 3: ODOT Safety Process

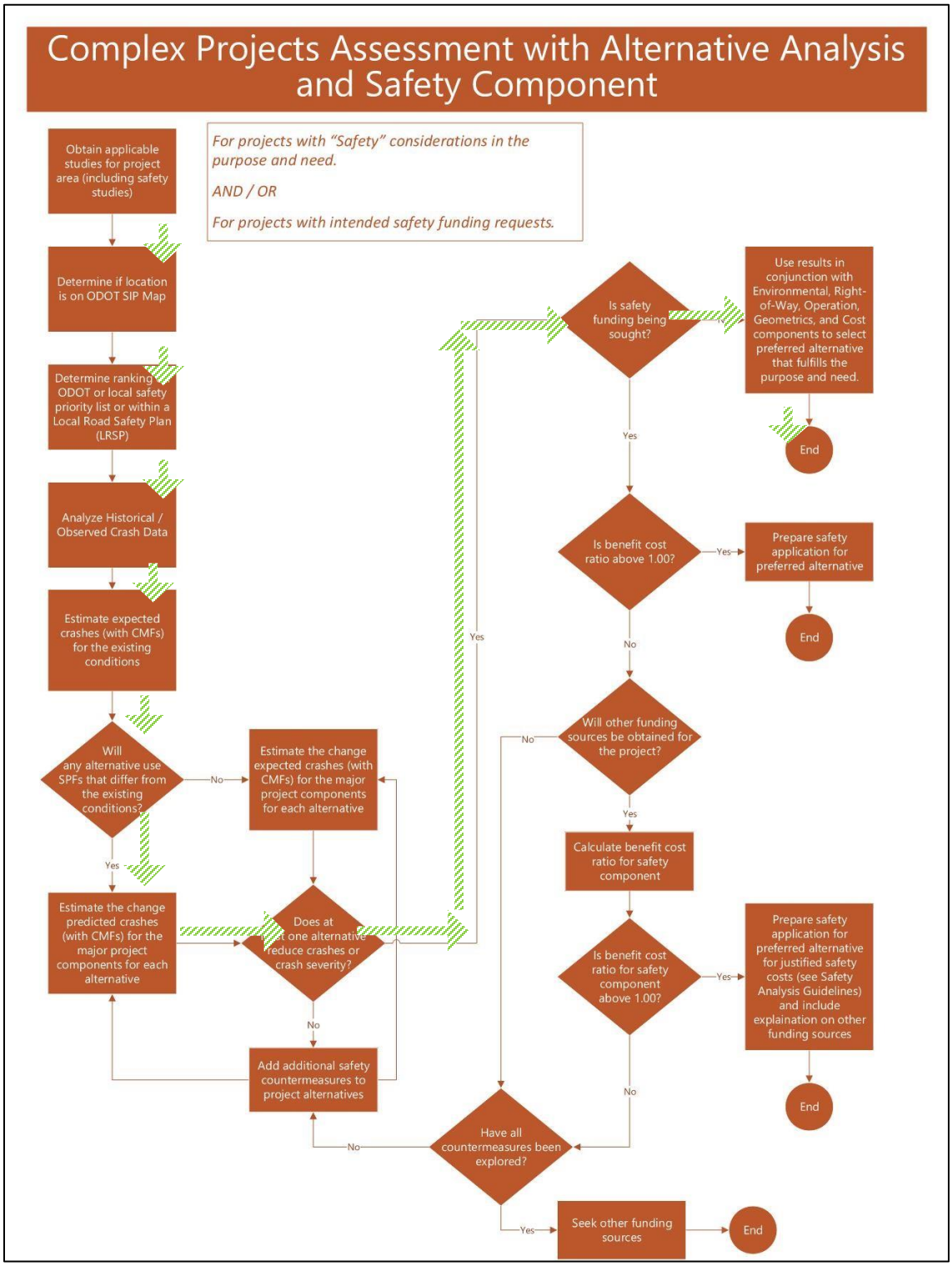


Chart Source: [ODOT Data-Driven Safety Analysis Process Diagram]

5. SAFETY PRIORITY LOCATIONS

5.1 KYTC Safety Priority Locations

LOSS is used to identify existing roadway segments with low safety performance that can be prioritized for improvement. Segments are ranked from LOSS 1 to 4, with 1 indicating a better safety performance and a low potential for crash reduction. LOSS 4 shows a worse-than-expected safety performance and a high potential for crash reduction. The following figures use the KABCO crash severity scale to present segment LOSS ranking. **Figure 4** shows the segment LOSS ranking for KAB (fatal, serious injury, minor injury) crashes and **Figure 5** illustrates the segment LOSS ranking for CO (possible injury or property damage only) crashes. Segments with LOSS 3 or 4 are highlighted in red. These figures indicate that most of the I-71/I-75 corridor between the southern project extent and the Brent Spence Bridge is flagged for safety concerns involving injury and property damage crashes.

Figure 4: Segment LOSS ranking for KAB crashes

Figure 5: Segment LOSS ranking for CO Crashes

Four segments in the Kentucky study limits have excessive expected crashes above 100 crashes per year. These segments are summarized in **Table 1** and show the segments with the greatest opportunity for crash reductions to be on I-71/75 between Beechwood Drive and Dixie Hwy, Kyles Lane and 12th Street, and on the Brent Spence Bridge.

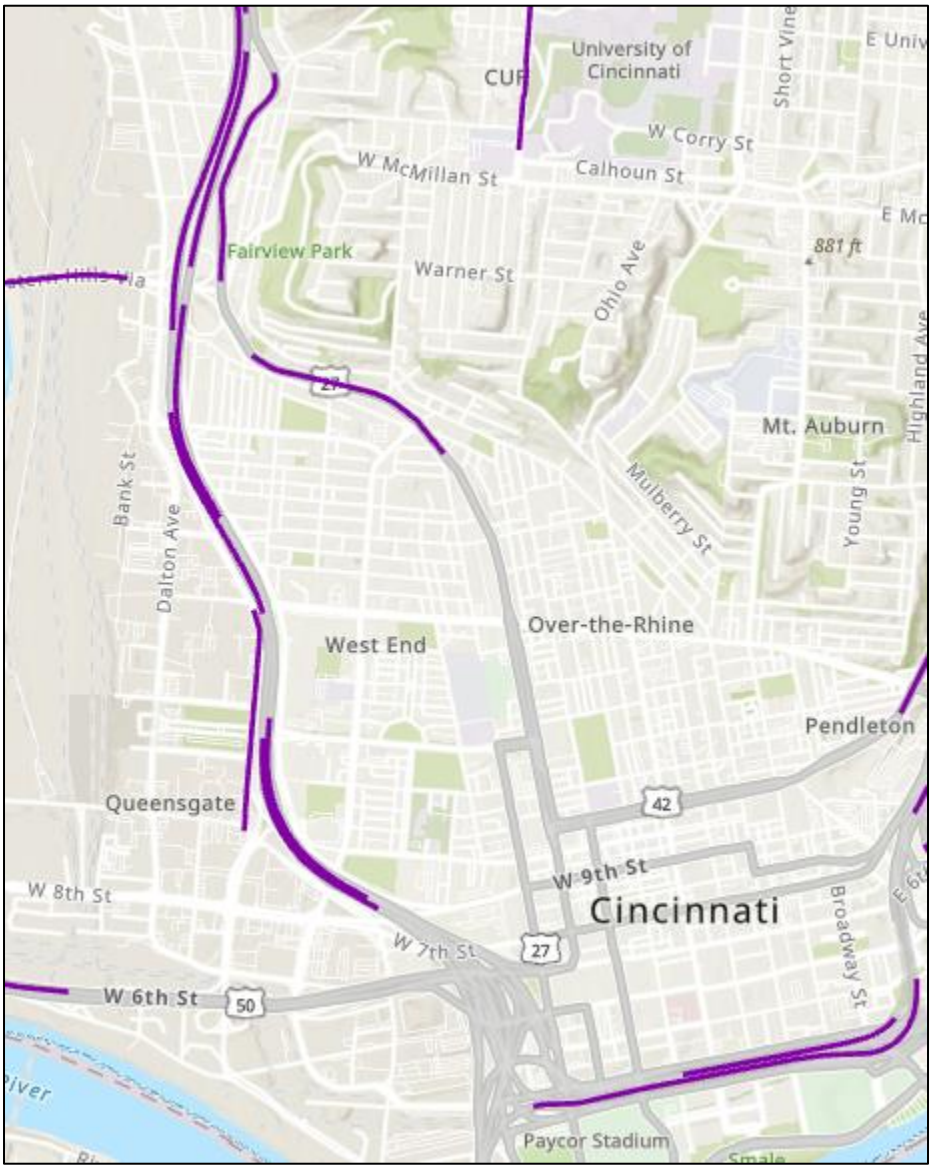
Table 1: Excessive Expected Total Crashes in Kentucky

Location	BMP	EMP	Length	EEC	LOSS
I-71/75: Beechwood Rd to Dixie Hwy	186.872	187.361	0.489	167	3
I-71/75: Kyles Lane to 12th Street	188.95	189.95	1	453	4
	189.95	190.155	0.205	172	4
I-71/75: Brent Spence Bridge	191.33	191.777	0.447	278	4

5.2 ODOT Highway Safety Improvement Program (HSIP) Priority Segments

The Highway Safety Improvement Program (HSIP) is a federal aid program that aims to reduce traffic fatalities and injuries on all public roadways. The HSIP follows a data-driven strategic approach to improve highway safety. **Figure 6** is a map of locations identified as priority segments according to ODOT's HSIP. These segments cover most of the I-75 project limits and I-71 to the eastern project extents. The Ohio project segment with the highest potential safety improvements (PSI) is SB I-75 between Bank Street and Linn Street, which has a PSI of 50 crashes per mile per lane. This ranks as the 7th highest PSI in Ohio according to ODOT's AASHTOware segment network screening.

Figure 6: HSIP Priority Segments in Ohio



6. HISTORICAL CRASH ANALYSIS

Crash data for the five years from 2019 to 2023 was collected from Ohio and Kentucky within the study area to identify crash patterns and trends. Kentucky crash data were obtained using Kentucky's Crash Data Queries tool through Kentucky's State Police Collision Analysis for the Public website. Ohio crash data were obtained using ODOT's AASHTOWare safety application. The historical crash analysis limits are shown in **Figure 7**. Crashes were filtered to the analysis limits and classified by roadway part: freeway, arterial, intersection, and ramp. The historical crash analysis covers the full study limits, including BSB Phases I, II, and III, plus adjacent intersections and freeway interchanges. The predictive safety analysis summarized in Section 7 covers only the Phase II and III project limits.

Figure 7: Historical Crash Analysis Study Limits

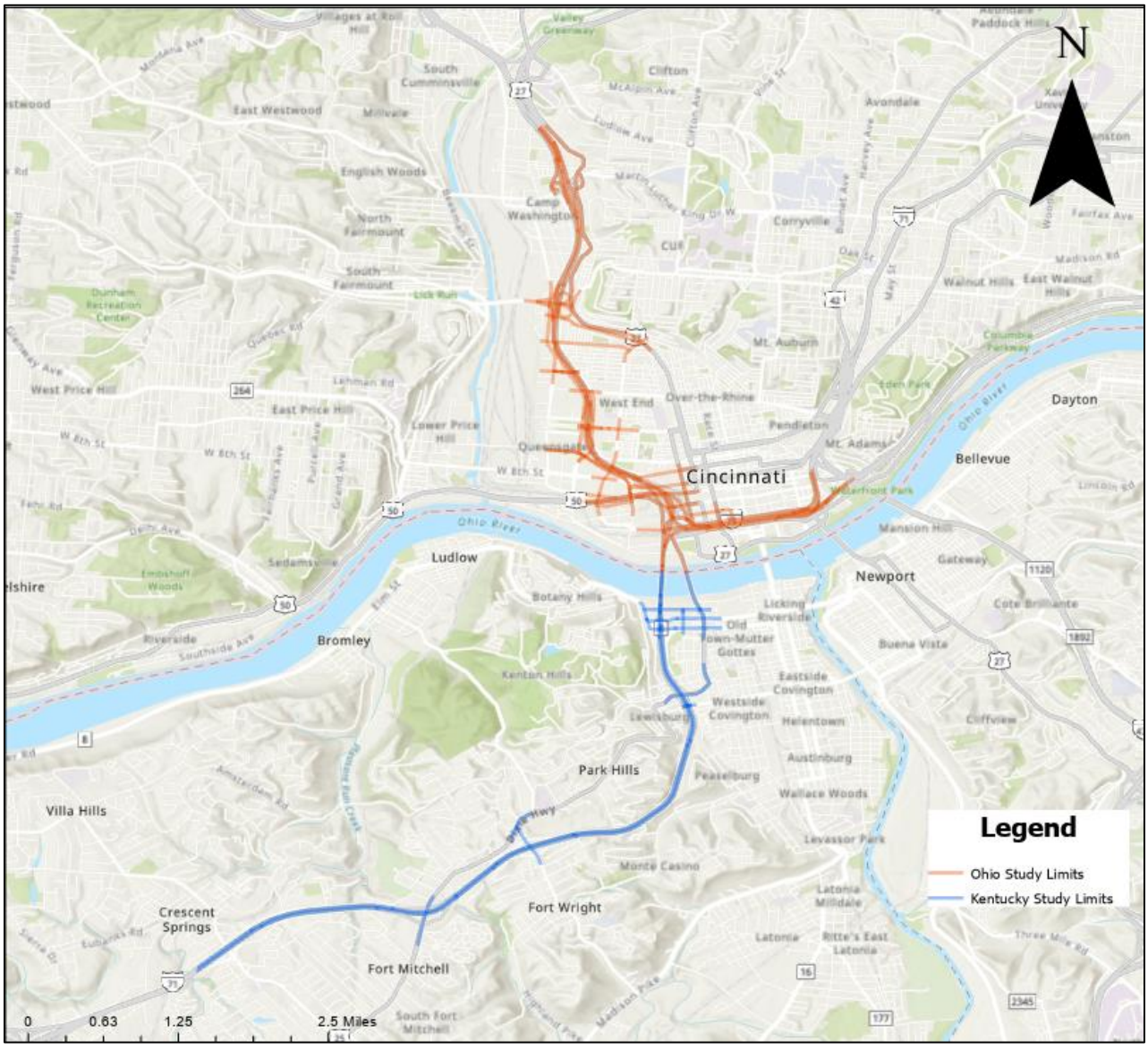


Table 2 and **Table 3** summarize the total number of crashes between 2019 and 2023 categorized by roadway part. In Kentucky, 4,600 crashes occurred during the analysis period. 2,913 (63.3%) of the crashes occur on the freeway, 718 (15.6%) of the crashes occur on arterial roadways, 730 (15.9%) of the crashes occur at or near intersections, and 239 (5.2%) occurred on ramps. In Ohio, 5,565 crashes occurred during the analysis period. 3,301 (59.3%) of the crashes occur on the freeway, 1,218 (21.9%) of the crashes occur on arterials, 733 (13.2%) of the crashes occur at or near intersections, and 313 (5.6%) of the crashes occur on ramp segments.

Table 2: Total Crashes by Roadway Part – Kentucky 2019-2023

Crash Location	2019	2020	2021	2022	2023	Total
Freeway	827	592	486	545	463	2913
Arterial	93	241	229	81	74	718
Intersection	142	150	193	137	108	730
Ramp	65	49	54	33	38	239
Total	1127	1032	962	796	683	4600

Table 3: Total Crashes by Roadway Part – Ohio 2019-2023

Crash Location	2019	2020	2021	2022	2023	Total
Freeway	755	614	675	559	698	3301
Arterial	255	247	274	235	207	1218
Intersection	179	159	125	138	132	733
Ramp	56	57	59	64	77	313
Total	1245	1077	1133	996	1114	5565

Figure 8 through **Figure 13** graphically shows various crash metrics for the BSB study limits. **Figure 8** shows the crash locations for arterial segments, ramp segments, and intersections. Mainline crashes are excluded from this figure. **Figure 9** shows all crashes in the full study area by injury severity. **Figure 10** shows severe crashes (KAB). **Figure 11** presents a crash density map for all crash severities. **Figure 12** presents a crash density map for severe injury crashes (KAB). **Figure 13** presents severe (KAB) pedestrian and bicycle crash locations.

Figure 8: Crash Locations by Roadway Part

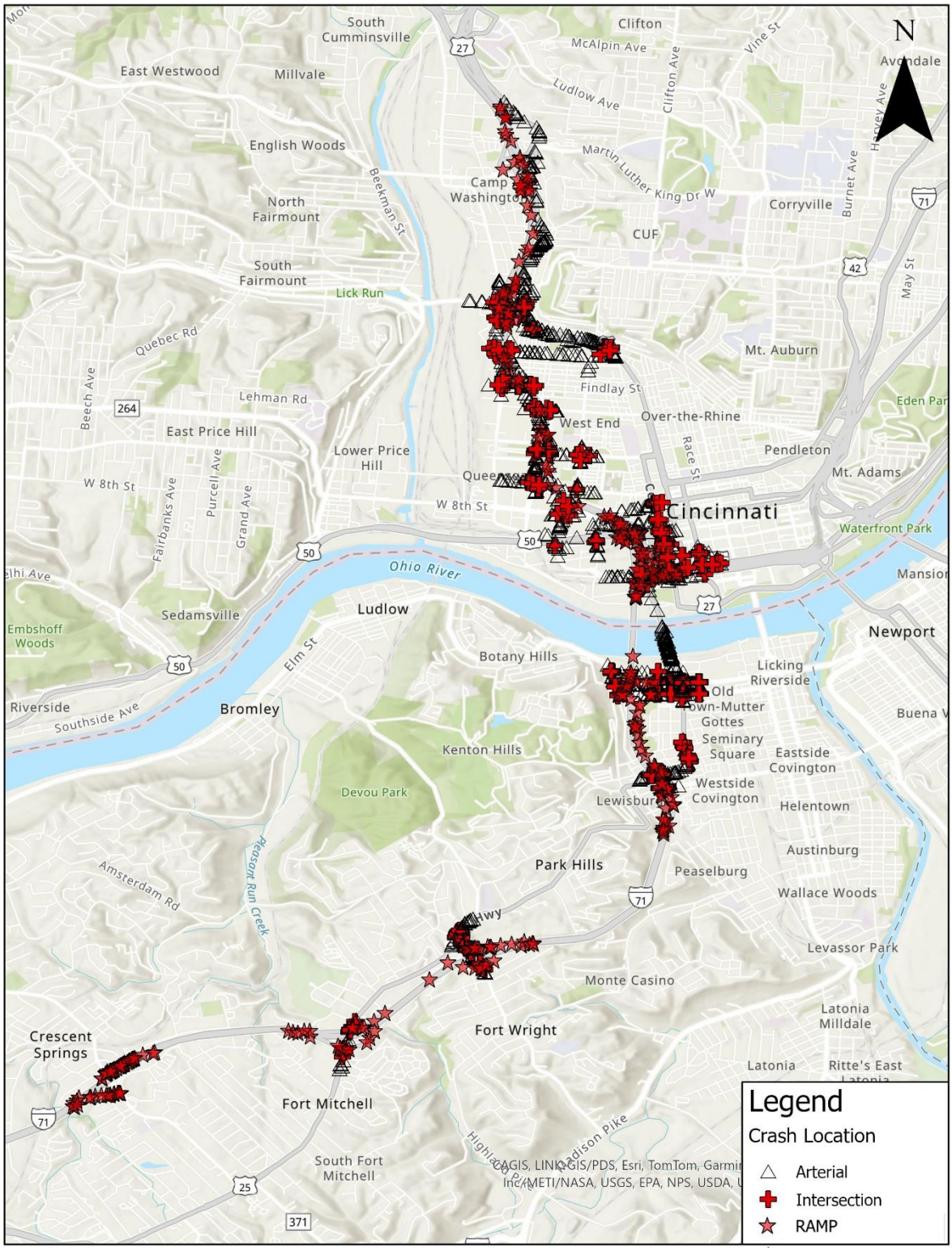


Figure 9: Crash Severity Locations (KABCO)

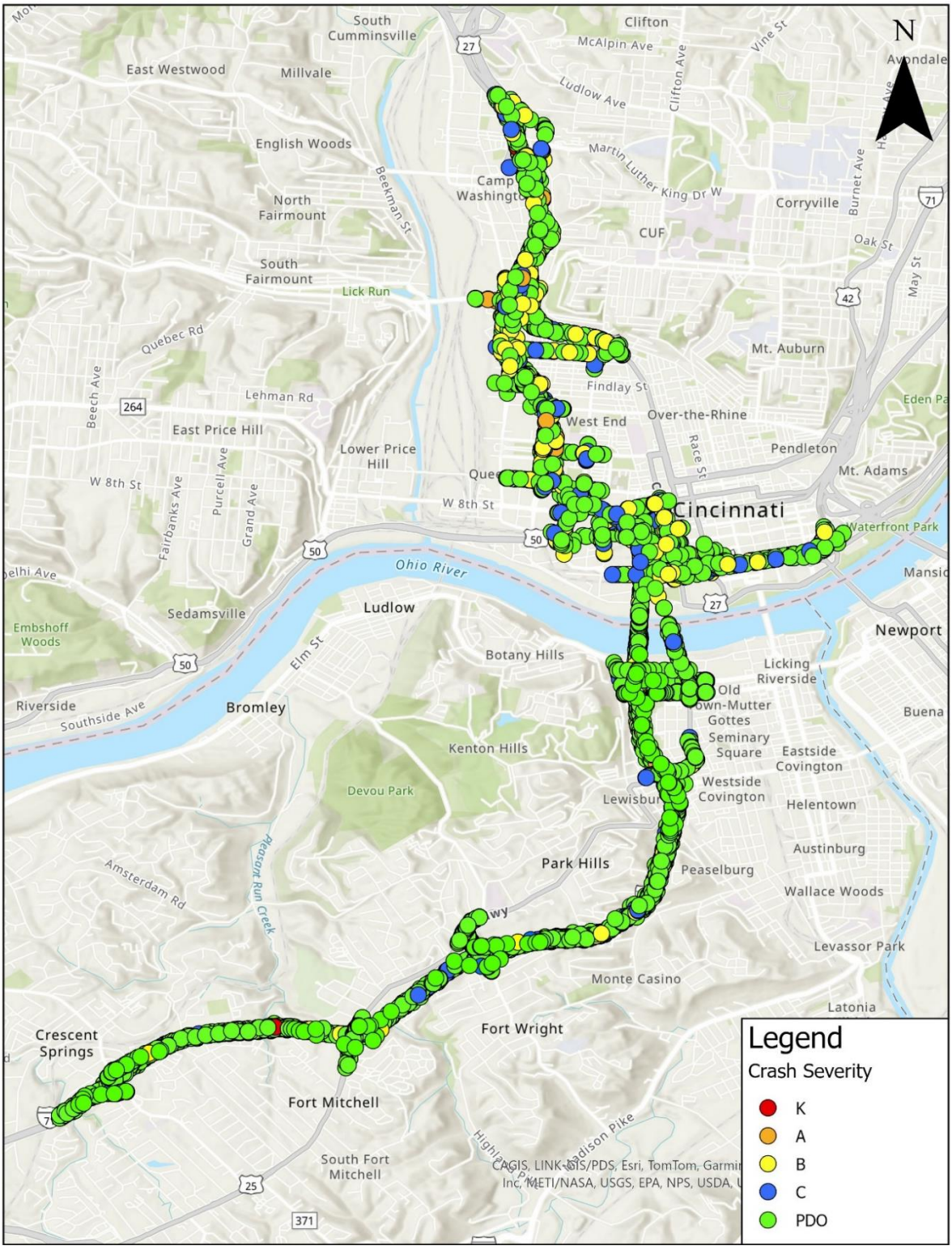


Figure 10: Crash Severity Locations (KAB)

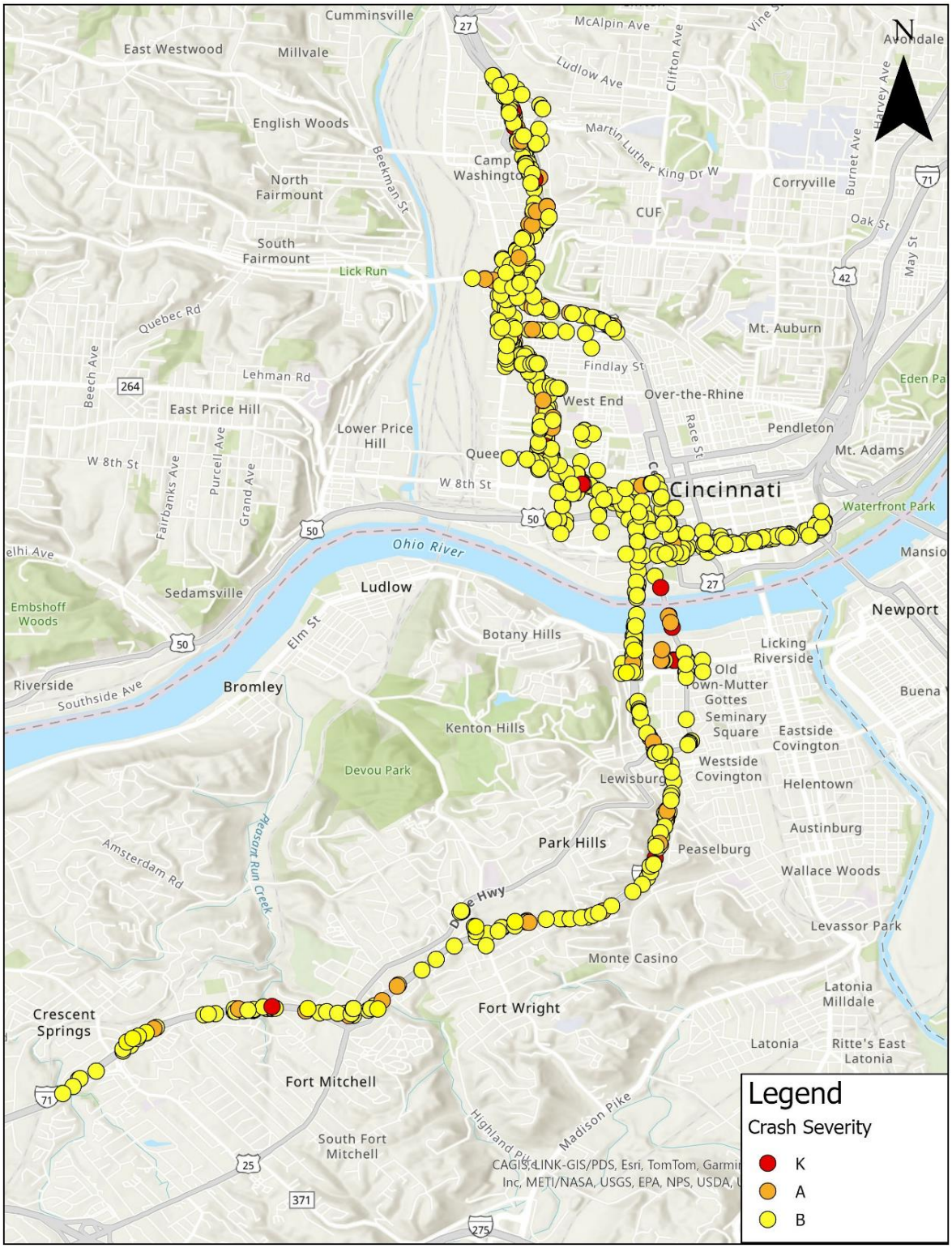


Figure 11: Crash Locations Density Map (KABCO)

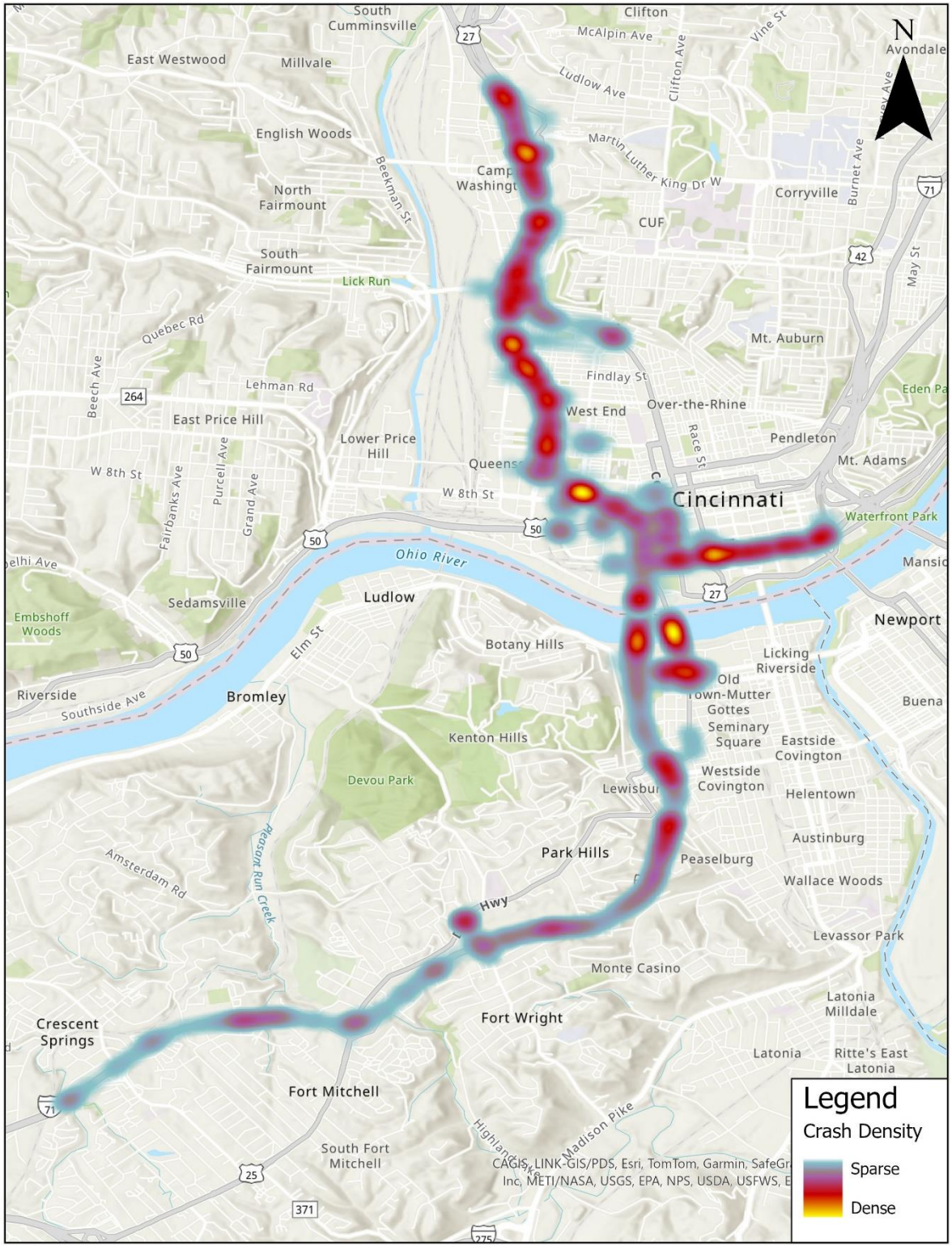


Figure 12: Crash Locations Density Map (KAB)

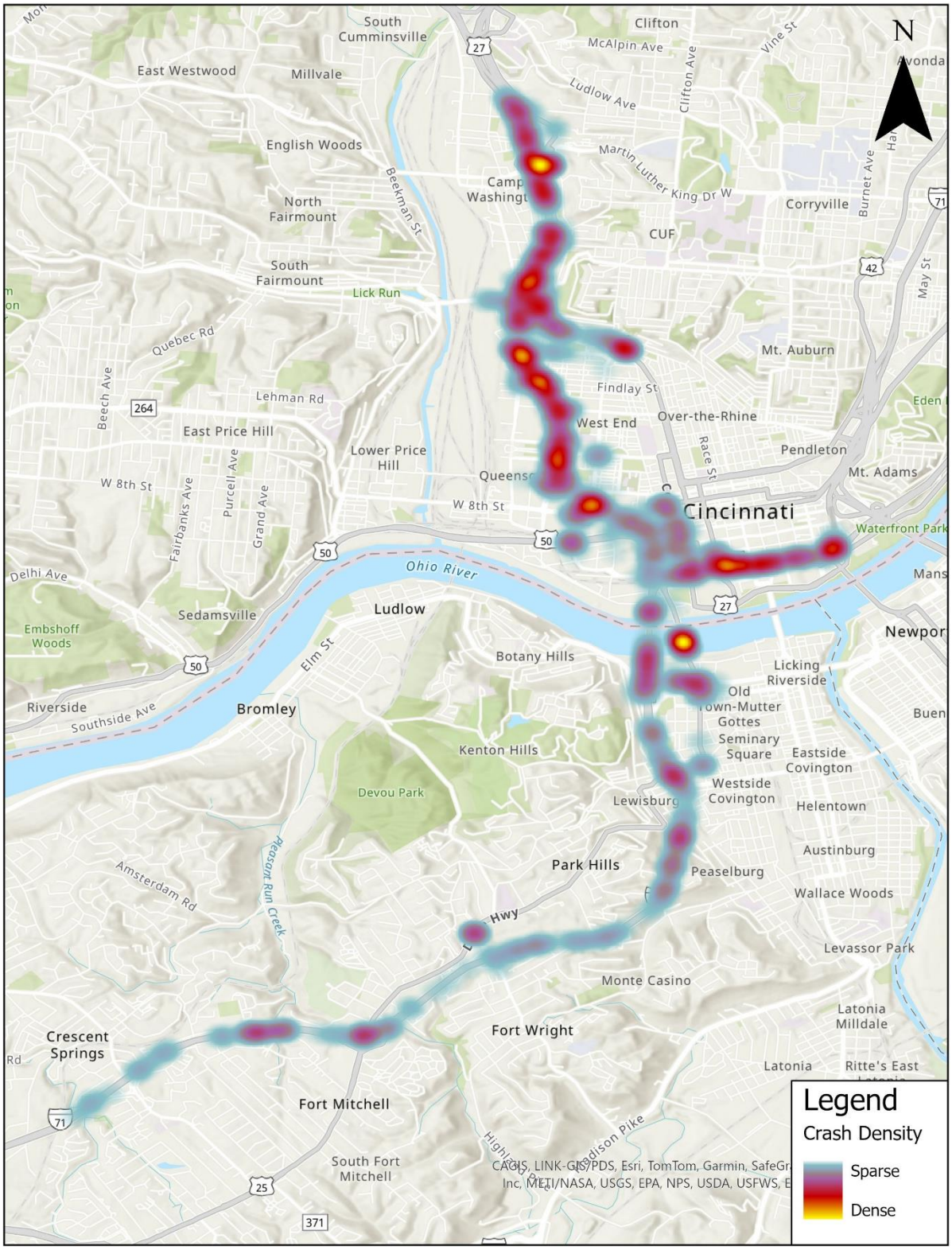
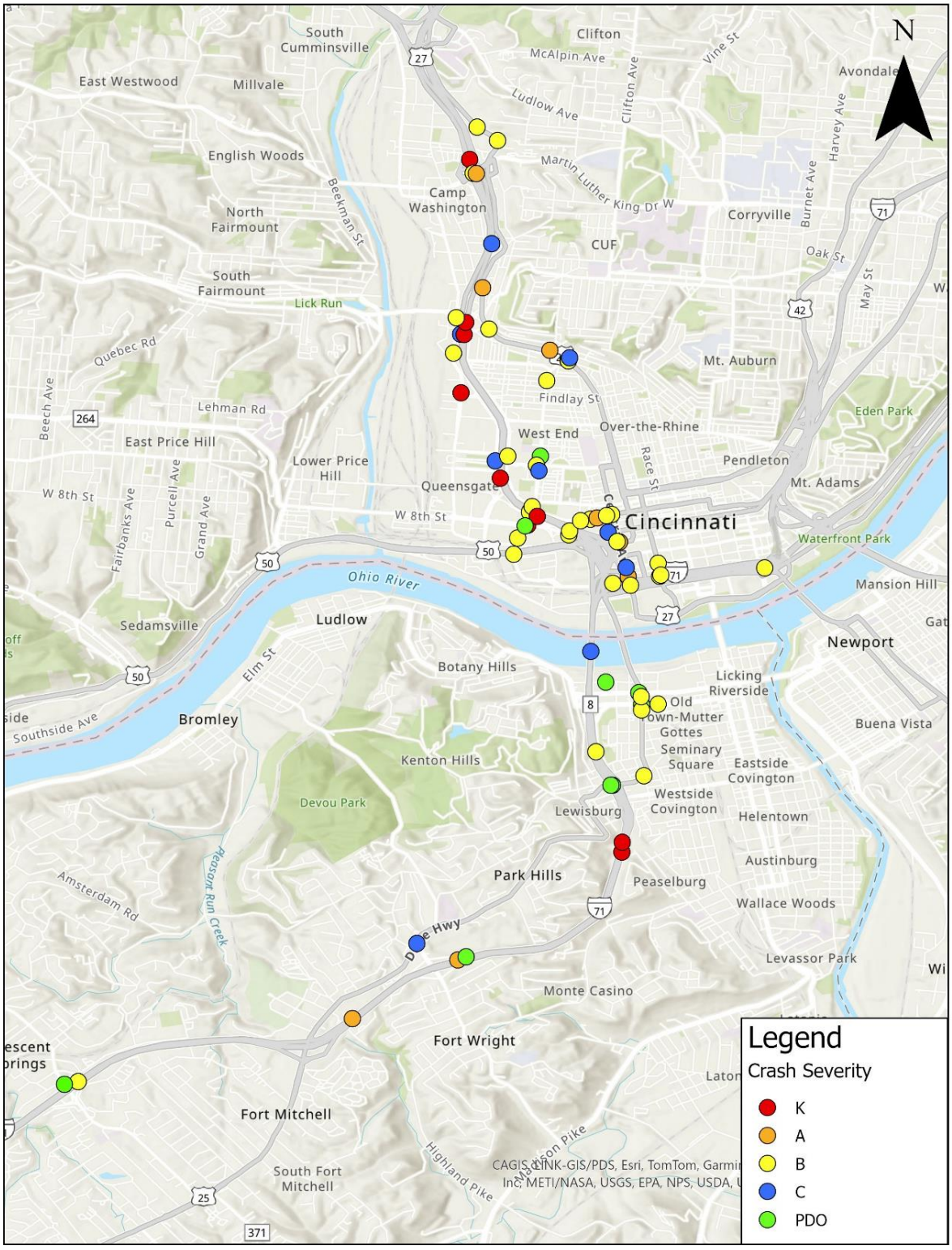


Figure 13: Pedestrian and Bicycle Severe Crash Locations (KABCO)



6.1 Kentucky Crash Trends

Kentucky's crash data from 2019 through 2023 shows that 4,600 crashes occurred within the project area. Crashes in Kentucky are reported according to the KABCO scale. Crashes are summarized in the following tables by injury severity, manner of collision, roadway condition, lighting condition, and day of the week to identify crash trends within the project area. Crash tables are divided by roadway parts, including freeways, arterials, and intersections. Within the entire Kentucky study area, there were nine fatal Injury (K) crashes across all roadway parts.

Freeway Crashes

As shown in **Table 4**, there were five fatal crashes (K), 17 suspected serious injury crashes (A), and 123 suspected minor injury crashes (B) on the freeway segments within the Kentucky study limits.

Table 4: Kentucky Freeway Crash Severity

Year	Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Total
2019	1	4	43	48	731	827
2020	0	6	23	42	521	592
2021	1	2	15	46	422	486
2022	3	3	20	27	492	545
2023	0	2	22	22	417	463
Total	5	17	123	185	2583	2913
5-year Annual Average	1	3.4	25	37	517	582.6
Severity % of Total	0%	1%	4%	6%	89%	100%

As shown in **Table 5,** the most common crash types for freeway segments are rear-end, sideswipe, and single-vehicle crashes. Rear-end crashes generally occur during peak operational hours when travel speeds are slow. Sideswipe crashes result from lane-changing maneuvers.

For the freeway segment type, the highest number by crash type was rear-end, with 1,504 crashes (52 percent), followed by sideswipe-same direction, with 976 crashes (34 percent), and single vehicle, with 317 crashes (11 percent) as shown in Table 5. These crash trends are consistent with the observations made from earlier safety studies in the corridor and crashes typical of congested urban freeway systems.

Table 5: Kentucky Freeway Crash Type

Crash Type	2019	2020	2021	2022	2023	Total
Rear End	439	293	249	285	238	1504
Sideswipe	242	176	183	198	177	976
Angle	17	13	9	16	10	65
Single Vehicle	113	101	38	34	31	317
Other	16	9	7	12	7	51
Total	827	592	486	545	463	2913

Table 6 summarizes crash type by roadway conditions. Seventy-four percent of crashes occur with dry pavement conditions. The crash trends based on pavement conditions are similar; however, single-vehicle crashes are more frequent during wet conditions than dry conditions.

Table 6: Kentucky Freeway Roadway Condition

Roadway Condition	Rear End	Sideswipe	Angle	Single Vehicle	Other	Total
Dry	1142	788	31	145	37	2143
Wet	351	182	27	149	10	719
Snow/Slush	6	3	4	10	2	25
Ice	2	0	2	3	1	8
Other/Unknown	3	3	1	10	1	18
Total	1504	976	65	317	51	2913

As shown in **Table 7**, most Kentucky freeway crashes occur in daylight or night but in lighted conditions.

Table 7: Kentucky Freeway Lighting Condition

Lighting Condition	Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Total
Daylight	2	10	76	129	1830	2047
Dark - Lighted Roadway	3	7	40	50	605	705
Dawn/Dusk	0	0	5	4	98	107
Dark - Not Lighted	0	0	1	1	37	39
Unknown	0	0	1	1	13	15
Total	5	17	123	185	2583	2913

As shown in **Table 8**, most Kentucky freeway crashes occur during weekdays of peak travel. Volumes on freeway segments are generally reduced on weekends, resulting in fewer but more severe crashes.

Table 8: Kentucky Freeway Day of the Week

Day of the Week	Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Total
Monday	1	0	16	27	370	414
Tuesday	0	3	15	29	365	412
Wednesday	1	2	18	18	379	418
Thursday	0	1	21	33	410	465
Friday	0	3	19	34	432	488
Saturday	1	4	17	21	283	326
Sunday	2	4	17	23	344	390
Total	5	17	123	185	2583	2913

Arterial Segments

As shown in **Table 9,** there was one fatal Injury (K) crashes on Kentucky's arterial segments between 2019 and 2023. This crash occurred in 2023 on the Clay Wade Bailey Bridge (CWB) and was a head-on crash. This crash can be partially attributed to the reversible center lane on the bridge. The lane configuration on the CWB will be changed as part of a project separate from the BSB to have one lane in each direction with a cycle track. This update will enhance the safety of the bridge by minimizing the likelihood of head-on crashes.

Table 9: Kentucky Arterial Crash Severity

Year	Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Total
2019	0	0	2	2	89	93
2020	0	7	2	22	210	241
2021	0	6	1	10	212	229
2022	0	6	3	3	69	81
2023	1	0	2	7	59	69
Total	1	19	10	44	639	713
5-year Annual Average	0.2	3.8	2	8.8	127.8	142.6
Severity % of Total	0%	3%	1%	6%	90%	100%

As shown in **Table 10**, the most common crash types on Kentucky's arterial segments are rear-end and sideswipe crashes.

Table 10: Kentucky Arterial Crash Type

Crash Type	2019	2020	2021	2022	2023	Total
Rear End	34	177	141	41	37	430
Sideswipe	33	35	65	20	18	171
Angle	15	13	10	13	3	54
Single Vehicle	9	6	5	3	8	31
Head On	0	8	8	1	1	18
Other	2	2	0	3	2	9
Total	93	241	229	81	69	713

As shown in **Table 11**, roadway conditions for the arterial segment crashes are generally dry. Roadway conditions do not appear to have any major influence on crash occurrence for this roadway segment type.

Table 11: Kentucky Arterial Roadway Condition

Roadway Condition	Rear End	Sideswipe	Angle	Single Vehicle	Other	Total
Dry	349	150	36	26	19	19
Wet	80	20	11	5	8	8
Snow/Slush	0	0	0	0	0	0
Ice	1	0	6	0	0	0
Other/Unknown	0	1	1	0	0	0
Total	430	171	54	31	27	27

As shown in **Table 12**, most crashes on arterial segments occur in daylight or dark but lighted conditions. Lighting conditions do not appear to have any major influence on crash occurrence for this roadway segment type.

Table 12: Kentucky Arterial Lighting Condition

Lighting Condition	Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Total
Daylight	1	6	6	33	465	511
Dark - Lighted Roadway	0	13	4	10	150	177
Dawn/Dusk	0	0	0	0	15	15
Dark - Not Lighted	0	0	0	0	1	1
Unknown	0	0	0	1	8	9
Total	1	19	10	44	639	713

As shown in **Table 13**, there is no trend in the severity or quantity of crashes by day of the week for the arterial segments.

Table 13: Kentucky Arterial Day of the Week

Day of the Week	Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Total
Monday	1	0	0	2	74	77
Tuesday	0	0	0	3	63	66
Wednesday	0	0	2	7	93	102
Thursday	0	6	1	3	108	118
Friday	0	0	4	8	120	132
Saturday	0	7	2	7	91	107
Sunday	0	6	1	14	90	111
Total	1	19	10	44	639	713

Intersections

As shown in **Table 14,** only one fatal crash occurred at Kentucky's intersections between 2019 and 2023. Most crashes at Kentucky's intersections cause property damage only. There was a spike in intersection crashes in 2021 compared to the other years of the study period.

Table 14: Kentucky Intersection Crash Severity

Year	Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Total
2019	1	2	12	8	119	142
2020	0	1	5	10	134	150
2021	0	0	6	10	177	193
2022	0	0	5	8	124	137
2023	0	0	6	4	98	108
Total	1	3	34	40	652	730
5-year Annual Average	0.2	0.6	7	8	130	146
Severity % of Total	0%	0%	5%	5%	89%	100%

As shown in **Table 15**, the most common crash types occurring at Kentucky's intersections are rear end, sideswipe, and angle.

Table 15: Kentucky Intersection Crash Type

Crash Type	2019	2020	2021	2022	2023	Total
Rear End	35	38	69	35	28	205
Sideswipe	28	33	40	30	18	149
Angle	64	66	71	63	50	314
Single Vehicle	9	5	7	6	5	32
Other	6	8	6	3	7	30
Total	142	150	193	137	108	730

There are no noteworthy trends for Kentucky intersection crashes by roadway condition, lighting condition, or day of week.

Ramps

As shown in **Table 16,** between 2019 and 2023, no fatal crashes occurred in Kentucky's study area ramp segments. Most crashes occurring on the ramp segments are property damage only.

Table 16: Kentucky Ramp Crash Severity

Year	Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Total
2019	0	0	4	4	57	65
2020	0	0	1	3	45	49
2021	0	0	0	1	53	54
2022	0	0	3	2	28	33
2023	0	0	4	2	32	38
Total	0	0	12	12	215	239
5-year Annual Average	0	0	2.4	2.4	43	47.8
Severity % of Total	0%	0%	5%	5%	90%	100%

As shown in **Table 17**, the most common crash types on Kentucky's ramping segments are rear-end, sideswipe, and single-vehicle crashes.

Table 17: Kentucky Ramp Crash Type

Crash Type	2019	2020	2021	2022	2023	Total
Rear End	38	29	38	16	23	144
Sideswipe	14	8	11	11	8	52
Angle	3	3	3	2	2	13
Single Vehicle	9	9	1	4	4	27
Other	1	0	1	0	1	3
Total	65	49	54	33	38	239

6.2 Ohio Crash Trends

Ohio's crash data from 2019 through 2023 show that 5,565 crashes occurred within the BSB project area. Crashes in Ohio are reported in five levels of severity on the OH-1 crash reports – Fatal, Serious Injury Suspected, Minor Injury Suspected, Injury Possible, and PDO. The highest number of crashes by crash type of freeway segment crashes is sideswipe-passing with a total of 1361 crashes (41 percent), followed by rear-end with a total of 1120 crashes (34 percent) and single vehicle with a total of 632 crashes (19 percent). These crash types are typical of an urban freeway system with many ramp interactions, weaving, and congestion. Within the Ohio study area, 15 fatal crashes occurred across all roadway parts.

Freeway

As shown in **Table 18,** between 2019 and 2023, 10 fatal crashes occurred on Ohio's freeway segments. Most crashes caused property damage only.

Table 18: Ohio Freeway Crash Severity

Year	Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Total
2019	0	5	92	74	584	755
2020	2	5	90	57	460	614
2021	3	3	79	64	526	675
2022	1	4	68	51	435	559
2023	4	8	94	60	532	698
Total	10	25	423	306	2537	3301
5-year Annual Average	2	5	85	61	507	660
Severity % of Total	0%	1%	13%	9%	77%	100%

As shown in **Table 19,** the most common crash types for the freeway segments are rear-end, sideswipe, and single-vehicle crashes. Rear-end crashes generally occur during peak operational hours when travel speeds are slow. Sideswipe crashes result from lane-changing maneuvers.

Table 19: Ohio Freeway Crash Type

Crash Type	Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Total
Rear End	2	8	145	117	848	1120
Sideswipe	1	6	134	103	1117	1361
Angle	0	0	7	0	19	26
Single Vehicle	1	5	111	70	445	632
Pedestrian	6	1	3	2	0	12
Other	0	5	23	14	108	150
Total	10	25	423	306	2537	3301

As shown in **Table 20,** sixty-five percent of the crashes on the Ohio freeway segments occur on dry pavement. Wet pavement reduces roadway friction, leading to an increase in single-vehicle crashes.

Table 20: Ohio Freeway Roadway Condition

Roadway Condition	Rear End	Sideswipe	Angle	Single Vehicle	Other	Total
Dry	809	1010	14	208	107	2148
Wet	297	322	11	392	50	1072
Snow/Slush	12	20	1	21	1	55
Ice	1	2	0	6	4	13
Other/Unknown	1	7	0	5	0	13
Total	1120	1361	26	632	162	3301

As shown in **Table 21**, most of Ohio's freeway crashes occur in daylight or night but in lighted conditions. This indicates that the Ohio freeway segment within the project limits has adequate lighting.

Table 21: Ohio Freeway Lighting Condition

Lighting Condition	Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Total
Daylight	2	8	263	216	1713	2202
Dark - Lighted Roadway	8	17	132	68	655	880
Dawn/Dusk	0	0	19	13	125	157
Dark - Not Lighted	0	0	9	8	43	60
Unknown	0	0	0	1	1	2
Total	10	25	423	306	2537	3301

As shown in **Table 22**: Ohio Freeway Day of the Week, most of Ohio's freeway crashes occur during weekdays of peak travel. Freeway volumes are generally reduced on weekends, resulting in fewer but more severe crashes. A higher proportion of crashes occur on Fridays compared to other days of the week.

Table 22: Ohio Freeway Day of the Week

Day of the Week	Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Total
Monday	0	3	54	41	348	446
Tuesday	1	2	48	47	396	494
Wednesday	3	3	84	33	382	505
Thursday	1	2	60	58	437	558
Friday	1	3	66	50	482	602
Saturday	1	9	55	35	262	362
Sunday	3	3	56	42	230	334
Total	10	25	423	306	2537	3301

Arterial Segments

As shown in **Table 23**, there were two fatal crashes and 32 suspected serious injury crashes that occurred on Ohio's arterial segments between 2019 and 2023.

Table 23: Ohio Arterial Crash Severity

Year	Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Total
2019	0	6	45	23	181	255
2020	1	8	35	26	177	247
2021	0	5	42	30	197	274
2022	0	11	47	23	154	235
2023	1	2	35	21	148	207
Total	2	32	204	123	857	1218
5-year Annual Average	0.4	6.4	41	25	171	244
Severity % of Total	0%	3%	17%	10%	70%	100%

As shown in **Table 24**, the most common crash types occurring on Ohio's arterial segments are rear end, sideswipe, single vehicle, and angle.

Table 24: Ohio Arterial Crash Type

Crash Type	2019	2020	2021	2022	2023	Total
Rear End	58	39	51	30	40	218
Sideswipe	59	44	66	66	49	284
Angle	68	90	79	63	56	356
Single Vehicle	32	42	36	47	29	186
Head On	5	11	12	4	10	42
Other	33	21	30	25	23	132
Total	255	247	274	235	207	1218

As shown in **Table 25,** wet roadways result in a proportionally higher frequency of single-vehicle crashes on these arterial segments.

Table 25: Ohio Arterial Roadway Condition

Roadway Condition	Rear End	Sideswipe	Angle	Single Vehicle	Other	Total
Dry	171	230	261	90	118	870
Wet	47	52	87	84	50	320
Snow/Slush	0	2	5	8	6	21
Ice	0	0	2	3	0	5
Other/Unknown	0	0	1	1	0	2
Total	218	284	356	186	174	1218

The crash data for the arterials indicate acceptable lighting conditions and consistent day-of-week crash patterns.

Intersections

As shown in **Table 26**, three fatal Injury (K) crashes occurred at Ohio's intersections between 2019 and 2023. Most crashes at Ohio's intersections cause property damage only. There are no notable trends relating to intersection crash severity for the study period.

Table 26: Ohio Intersection Crash Severity

Year	Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Total
2019	0	1	34	26	118	179
2020	2	3	29	15	110	159
2021	0	2	29	12	82	125
2022	1	2	20	11	104	138
2023	0	0	25	21	86	132
Total	3	8	137	85	500	733
5-year Annual Average	0.6	1.6	27	17	100	147
Severity % of Total	0%	1%	19%	12%	68%	100%

As shown in **Table 27**, the most common crash types occurring at Ohio's intersections are rear end, sideswipe, and angle. There have been three fatal crashes, with two of those crashes involving a pedestrian.

Table 27: Ohio Intersection Crash Type

Crash Type	Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Total
Rear End	0	1	15	13	71	100
Sideswipe	0	1	15	10	148	174
Angle	1	4	86	53	225	369
Single Vehicle	0	1	3	3	24	31
Pedestrian	2	1	10	4	1	18
Other	0	0	8	2	31	41
Total	3	8	137	85	500	733

As shown in **Table 28**, roadway conditions for intersection crashes are generally dry. Roadway conditions do not appear to have any major influence on crash occurrence at intersections.

Table 28: Ohio Intersection Roadway Condition

Roadway Condition	Rear End	Sideswipe	Angle	Single Vehicle	Other	Total
Dry	72	156	298	22	45	593
Wet	25	18	66	8	14	131
Snow/Slush	1	0	4	1	0	6
Ice	0	0	0	0	0	0
Other/Unknown	2	0	1	0	0	3
Total	100	174	369	31	59	733

The crash data for the intersections indicate acceptable lighting conditions and consistent day-of-week crash patterns.

Ramps

As shown in **Table 29,** between 2019 and 2023, no fatal crashes occurred in Ohio's study area ramp segments. Most crashes occurring on the ramp segments are property damage only.

Table 29: Ohio Ramp Crash Severity

Year	Fatal Injury (K)	Suspected Serious Injury (A)	Suspected Minor Injury (B)	Possible Injury (C)	Property Damage Only (O)	Total
2019	0	0	4	7	45	56
2020	0	2	9	4	42	57
2021	0	0	9	6	44	59
2022	0	2	6	8	48	64
2023	0	0	11	5	61	77
Total	0	4	39	30	240	313
5-year Annual Average	0	0.8	8	6	48	62.6
Severity % of Total	0%	1%	12%	10%	77%	100%

As shown in **Table 30**, Ohio's ramp segments' most common crash types are rear-end, sideswipe, and single vehicle.

Table 30: Ohio Ramp Crash Type

Crash Type	2019	2020	2021	2022	2023	Total
Rear End	17	19	17	22	26	101
Sideswipe	13	12	21	20	25	91
Angle	1	0	3	1	0	5
Single Vehicle	19	22	13	18	20	92
Other	6	4	5	3	6	24
Total	56	57	59	64	77	313

6.3 Site-Specific Crash Summary

This section provides additional crash details on a site-by-site basis, summarized by roadway part. The tables provide the total number of crashes per site, with the crash severity and types summarized as percentages of the totals.

Freeway Mainline

The freeway mainline crashes are summarized in **Table 31**. This summary indicates that the KAB crash severity is higher in the Ohio segments. Kentucky property damage-only crashes represent about 90% of all crashes. Rear-end crashes are the leading type in Kentucky, with sideswipes as the major crash type in Ohio. The build alternatives offer operational benefits compared to the No-Build that will reduce the rear-end crash type. The sideswipe crashes are also anticipated to be mitigated with the C-D road system in both states and widened lane and shoulder widths on the BSB and companion bridges.

Table 31: Mainline Segment Crashes

Segment	Distance	Total Crashes	Crash Severity				Crash Type			
			K/A	B	C	PD	Rear End	Side-swipe	Single Veh	Other
I-71/I-75: Southern Limits to Buttermilk Pike	0.76 mi	124	0%	4%	6%	90%	57%	33%	6%	4%
I-71/I-75: Buttermilk Pike to Dixie Hwy	1.41 mi	537	1%	5%	7%	87%	58%	21%	16%	5%
I-71/I-75: Dixie Hwy to Kyles Lane	0.95 mi	276	1%	4%	8%	88%	49%	32%	14%	6%
I-71/I-75: Kyles Lane to 12th Street	1.82 mi	1210	1%	3%	7%	89%	55%	31%	11%	3%
I-71/I-75: 12th Street to 4th Street	0.83 mi	334	1%	5%	7%	87%	47%	38%	10%	4%
I-71/I-75: 4th Street to Mehring Way (Brent Spence Bridge)	0.64 mi	592	0%	6%	5%	89%	37%	53%	5%	5%
I-75: Mehring Way to 8th Street	0.87 mi	280	0%	9%	8%	83%	36%	37%	22%	5%
I-75: 8th Street to Liberty	0.93 mi	516	2%	12%	10%	76%	28%	44%	19%	8%
I-75: Liberty to WHV	0.85 mi	538	1%	12%	10%	76%	31%	44%	20%	5%
I-75: WHV to Hopple Street	1.06 mi	707	2%	15%	9%	74%	30%	50%	15%	4%
I-75: Hopple Street to Northern Limits	0.52 mi	388	2%	12%	7%	79%	28%	48%	14%	8%
I-71: between I-75 and Eastern Limits	0.85 mi	650	0%	15%	9%	76%	49%	24%	24%	4%
US50: Western Limits and I-71	0.41 mi	53	0%	11%	8%	81%	23%	25%	45%	6%
US50: I-71 and Eastern Limits	0.38 mi	9	0%	11%	11%	78%	44%	22%	33%	0%

Arterial Segments

The arterial segment (non-intersection) crashes are summarized for Kentucky in **Table 32** and Ohio in **Table 33**. In general, segment crashes frequencies are low with the majority of these crashes as property-damage only.

Table 32: Kentucky Arterial Segment Crashes

Segment	Total Crashes	Crash Severity				Crash Type				
		K/A	B	C	PD	Rear End	Angle	Side-swipe	Single Veh	Other
Dixie Hwy: Beechwood to I-71/I-75 NB Ramps	5	0%	0%	0%	100%	20%	0%	40%	0%	40%
Dixie Hwy: I-71/I-75 NB Ramps to I-71/I-75 SB Ramps	2	0%	0%	0%	100%	50%	0%	50%	0%	0%
Dixie Hwy: I-71/I-75 SB Ramps to Orchard Rd	5	0%	0%	0%	100%	60%	0%	20%	0%	20%
Kyles Ln: Kennedy Rd to I-71/I-75 NB Ramps	3	0%	0%	0%	100%	67%	0%	33%	0%	0%
Kyles Ln: I-71/I-75 NB Ramps to I-71/I-75 SB Ramps	19	0%	0%	0%	100%	74%	5%	21%	0%	0%
Kyles Ln: I-71/I-75 SB Ramps to Dixie Hwy	9	0%	0%	0%	100%	56%	0%	11%	22%	11%
Dixie Hwy: Barrington Rd to Kyles Ln	5	0%	0%	0%	100%	40%	0%	60%	0%	0%
Dixie Hwy: Kyles Ln to Sleepy Hollow Rd	15	0%	0%	7%	93%	20%	40%	40%	0%	0%
12th St: Bullock St to Simon Kenton Way	4	0%	0%	0%	100%	50%	0%	25%	25%	0%
12th St: Simon Kenton Way to Main St	3	0%	0%	0%	100%	67%	0%	33%	0%	0%
Pike St: Western Ave to Bullock St	6	0%	0%	17%	83%	17%	0%	67%	0%	17%
Pike St: Bullock St to Simon Kenton Way	5	0%	20%	20%	60%	40%	0%	20%	40%	0%
Pike St: Simon Kenton Way to Main St	16	0%	13%	19%	69%	38%	44%	6%	13%	0%
Pike St: Main St to Main St	9	0%	22%	0%	78%	22%	33%	0%	33%	11%
Main St: Pike St to 9th St	5	0%	0%	20%	80%	0%	40%	20%	20%	20%
Main St: 9th St to 5th St	6	0%	33%	17%	50%	0%	17%	50%	17%	17%
Main St: 5th St to 4th St	12	0%	8%	8%	83%	8%	58%	8%	17%	8%
Main St: 4th St to 3rd St	14	0%	7%	0%	93%	79%	7%	14%	0%	0%
5th St: Crescent to Philadelphia St	13	0%	0%	0%	100%	46%	0%	31%	15%	8%
5th St: Philadelphia St to Bakewell St	6	0%	0%	0%	100%	17%	17%	33%	33%	0%
5th St: Bakewell St to Main St	4	0%	0%	25%	75%	50%	0%	50%	0%	0%
5th St: Main St to Johnson St	9	0%	0%	0%	100%	11%	11%	78%	0%	0%
4th St: Crescent to Philadelphia St	16	0%	0%	0%	100%	25%	0%	50%	19%	6%
4th St: Philadelphia St to Bakewell St	22	0%	5%	0%	95%	18%	18%	59%	0%	5%
4th St: Bakewell St to Main St	10	10%	0%	20%	70%	40%	10%	40%	10%	0%
4th St: Main St to Johnson St	18	0%	0%	6%	94%	6%	33%	50%	0%	11%
Crescent: 4th St to 3rd St	3	0%	0%	33%	67%	0%	100%	0%	0%	0%
Crescent: 3rd St to Western Ave	2	0%	0%	0%	100%	0%	0%	100%	0%	0%
3rd St: Crescent to Philadelphia St	6	0%	0%	0%	100%	0%	50%	17%	33%	0%
3rd St: Philadelphia St to Bakewell St	2	0%	0%	0%	100%	50%	0%	0%	50%	0%
3rd St: Bakewell St to Main St	2	0%	0%	0%	100%	0%	50%	50%	0%	0%
Clay Wade Bailey Bridge	457	4%	0%	7%	89%	76%	1%	18%	1%	3%

Table 33: Ohio Arterial Segment Crashes

Segment	Total Crashes	Crash Severity				Crash Type				
		K/A	B	C	PD	Rear End	Angle	Side-swipe	Single Veh	Other
2nd St: CWB to Elm St	13	0%	15%	8%	77%	8%	31%	31%	15%	15%
Elm St: 3rd St to 4th St	4	0%	0%	0%	100%	0%	50%	0%	0%	50%
Elm St: 4th St to 5th St	1	0%	0%	0%	100%	0%	100%	0%	0%	0%
3rd St: Gest St to CWB	51	0%	6%	20%	75%	29%	45%	16%	8%	2%
3rd St: CWB to Central Ave	23	0%	9%	9%	83%	26%	43%	17%	4%	9%
3rd St: Central Ave to Plum St	16	6%	13%	0%	81%	44%	19%	25%	13%	0%
3rd St: Plum St to Elm St	5	0%	0%	0%	100%	20%	40%	0%	0%	40%
3rd St: Elm St to Race St	4	0%	25%	0%	75%	25%	25%	50%	0%	0%
3rd St: Race St to Vine St	1	0%	0%	0%	100%	0%	0%	100%	0%	0%
Central Ave: Pete Rose Way to 3rd St	27	4%	4%	0%	93%	33%	33%	15%	7%	11%
Central Ave: 3rd St to 4th St	4	25%	0%	0%	75%	25%	50%	0%	0%	25%
Central Ave: 4th St to 5th St	7	0%	14%	0%	86%	43%	14%	29%	0%	14%
Central Ave: 5th St to 6th St	3	0%	33%	0%	67%	33%	33%	33%	0%	0%
Central Ave: 6th St to 7th St	2	0%	0%	0%	100%	0%	0%	100%	0%	0%
Central Ave: 7th St to 8th St	5	0%	20%	0%	80%	40%	0%	20%	0%	40%
Central Ave: 8th St to 9th St	1	0%	0%	0%	100%	0%	0%	100%	0%	0%
Central Ave: 9th St to Court St	3	0%	0%	33%	67%	0%	33%	33%	33%	0%
Race St: 3rd St to 4th St	5	0%	20%	0%	80%	0%	20%	20%	0%	60%
4th St: Central Ave to Plum St	3	0%	33%	0%	67%	0%	33%	33%	0%	33%
4th St: Race St to Elm St	2	0%	0%	0%	100%	50%	0%	0%	0%	50%
5th St: 6th St to Central Ave	2	0%	50%	0%	50%	0%	50%	50%	0%	0%
5th St: Central Ave to Plum St	10	0%	0%	0%	100%	10%	0%	50%	0%	40%
Gest St: 5th St to 6th St	6	0%	17%	33%	50%	17%	33%	17%	17%	17%
Gest St: 6th St to Linn St	26	0%	8%	8%	85%	23%	8%	31%	35%	4%
Gest St: Linn St to Freeman Ave	4	0%	25%	0%	75%	0%	25%	0%	50%	25%
Gest St: Dalton Ave to Western Ave	15	0%	13%	0%	87%	13%	47%	0%	20%	20%
Linn St: 5th St to 6th St	1	0%	100%	0%	0%	0%	100%	0%	0%	0%
Linn St: 6th St to Dalton Ave	15	7%	33%	13%	47%	7%	27%	33%	7%	27%
Linn St: Dalton Ave to 8th St	15	0%	13%	0%	87%	7%	47%	33%	0%	13%
Linn St: 8th St to Gest St	15	0%	20%	7%	73%	7%	60%	7%	13%	13%
Linn St: Gest St to Court St	7	0%	57%	14%	29%	0%	43%	0%	0%	57%
Linn St: Court St to Clark St	6	0%	17%	0%	83%	0%	50%	33%	0%	17%
Linn St: Clark St to Ezzard Charles Dr	5	0%	40%	0%	60%	20%	60%	0%	0%	20%
Linn St: Ezzard Charles Dr to Liberty St	5	0%	0%	0%	100%	0%	80%	0%	0%	20%
6th St: Linn St to Gest St	12	0%	8%	17%	75%	50%	8%	25%	17%	0%
6th St: I-71/I-75 Ramps to Central Ave	2	0%	0%	0%	100%	0%	0%	0%	100%	0%
6th St: Central Ave to Plum St	17	0%	18%	18%	65%	12%	18%	41%	6%	24%

Segment	Total Crashes	Crash Severity				Crash Type				
		K/A	B	C	PD	Rear End	Angle	Side-swipe	Single Veh	Other
6th St: Plum St to Elm St	2	0%	0%	0%	100%	0%	50%	0%	50%	0%
Dalton Ave: Freeman Ave to Linn St	2	0%	0%	50%	50%	50%	0%	0%	50%	0%
Dalton Ave: Linn St to 6th St	1	0%	0%	0%	100%	0%	0%	0%	0%	100%
7th St: Linn St to Central Ave	17	0%	18%	18%	65%	0%	6%	47%	24%	24%
8th St: Freeman Ave to Linn St	24	0%	21%	13%	67%	25%	17%	38%	4%	17%
8th St: Linn St to Winchell Ave	12	0%	17%	8%	75%	8%	25%	42%	17%	8%
9th St: Winchell Ave to Central Ave	30	7%	27%	13%	53%	10%	23%	37%	7%	23%
9th St: Central Ave to Plum St	1	0%	0%	0%	100%	0%	100%	0%	0%	0%
Court St: Circle to Linn St	2	0%	0%	0%	100%	0%	50%	0%	0%	50%
Court St: Linn St to Cutter St	4	0%	25%	25%	50%	0%	25%	50%	0%	25%
Freeman Ave: 8th St to Gest St	22	0%	18%	14%	68%	14%	64%	18%	5%	0%
Freeman Ave: Gest St to Winchell Ave	4	0%	25%	25%	50%	0%	50%	25%	25%	0%
Winchell Ave: Freeman Ave to Ezzard Charles Dr	1	0%	0%	0%	100%	0%	0%	0%	100%	0%
Winchell Ave: Ezzard Charles Dr to Liberty St	22	9%	23%	0%	68%	14%	55%	23%	5%	5%
Winchell Ave: Findlay St to Bank St	46	2%	9%	11%	78%	9%	24%	28%	35%	4%
Winchell Ave: Bank St to Harrison Ave	1	0%	100%	0%	0%	0%	0%	100%	0%	0%
Western Ave: Gest St to Hopkins St	36	0%	17%	3%	81%	33%	14%	25%	8%	19%
Western Ave: Hopkins St to Ezzard Charles Dr	8	0%	0%	25%	75%	13%	13%	63%	0%	13%
Western Ave: Ezzard Charles Dr to Kenner St	8	13%	13%	0%	75%	25%	13%	25%	0%	38%
Western Ave: Kenner St to Liberty St	59	3%	10%	12%	75%	29%	15%	31%	19%	7%
Western Ave: Liberty St to Findlay St	12	0%	17%	0%	83%	25%	25%	42%	8%	0%
Ezzard Charles Dr: Winchell Ave to Linn St	4	0%	0%	0%	100%	25%	0%	0%	0%	75%
Ezzard Charles Dr: Linn St to John St	13	0%	8%	23%	69%	8%	31%	31%	8%	23%
Liberty St: Dalton Ave to Western Ave	1	0%	0%	0%	100%	100%	0%	0%	0%	0%
Liberty St: Winchell Ave to Linn St	10	0%	20%	0%	80%	0%	20%	80%	0%	0%
Dalton Ave: Liberty St to Findlay St	1	0%	0%	0%	100%	100%	0%	0%	0%	0%
Dalton Ave: Findlay St to Bank St	11	0%	18%	0%	82%	18%	18%	36%	27%	0%
Spring Grove Ave: Bank St to Harrison Ave	6	0%	50%	0%	50%	17%	0%	33%	33%	17%
Spring Grove Ave: Harrison Ave to WHV	1	0%	0%	0%	100%	0%	0%	100%	0%	0%
Spring Grove Ave: WHV to Draper St	14	0%	36%	7%	57%	14%	14%	43%	14%	14%
Findlay St: Mclean Ave to Dalton Ave	1	0%	0%	0%	100%	0%	100%	0%	0%	0%
Findlay St: Dalton Ave to Western Ave	3	0%	0%	33%	67%	0%	67%	33%	0%	0%
Findlay St: Western Ave to Winchell Ave	4	0%	50%	0%	50%	25%	50%	0%	25%	0%
Bank St: Winchell Ave to Colerain Ave	11	9%	9%	18%	64%	9%	45%	18%	9%	18%

Segment	Total Crashes	Crash Severity				Crash Type				
		K/A	B	C	PD	Rear End	Angle	Side-swipe	Single Veh	Other
Bank St: Colerain Ave to Western Ave	15	0%	27%	13%	60%	7%	67%	13%	7%	7%
Bank St: Freeman Ave to Linn St	13	0%	15%	15%	69%	31%	46%	8%	15%	0%
Linn St: Liberty St to Bank St	6	0%	17%	17%	67%	33%	33%	0%	0%	33%
Linn St: Bank St to Central Ave	3	0%	0%	0%	100%	0%	0%	67%	33%	0%
Mohawk Pl: Central Pkwy to McMicken Ave	3	0%	0%	0%	100%	33%	0%	33%	0%	33%
Harrison Ave: Winchell Ave to Colerain Ave	10	10%	20%	0%	70%	0%	0%	10%	40%	50%
Harrison Ave: Colerain Ave to Freeman Ave	6	0%	17%	0%	83%	17%	17%	0%	0%	67%
Harrison Ave: Freeman Ave to Linn St	10	0%	0%	0%	100%	0%	10%	40%	10%	40%
WHV: State Ave to Central Pkwy	43	5%	23%	12%	60%	26%	23%	21%	19%	12%
McMillan St: Central Pkwy to McMicken Ave	10	0%	50%	10%	40%	10%	40%	10%	20%	20%
Central Pkwy: Findlay St to Mohawk Pl	13	0%	8%	15%	77%	31%	38%	23%	0%	8%
Central Pkwy: Mohawk Pl to Ravine St	15	0%	27%	20%	53%	7%	60%	13%	7%	13%
Central Pkwy: Ravine St to Brighton Pl	58	7%	19%	10%	64%	16%	14%	16%	19%	36%
Central Pkwy: Brighton Pl to WHV	49	2%	16%	12%	69%	18%	37%	22%	18%	4%
Central Pkwy: WHV to Marshall Ave	99	8%	17%	15%	60%	12%	32%	10%	29%	16%
Central Pkwy: Marshall Ave to MLK Dr	16	13%	6%	6%	75%	0%	25%	13%	63%	0%
Central Pkwy: MLK Dr to Monmouth Ave	23	0%	17%	9%	74%	13%	17%	26%	26%	17%
Central Pkwy: Monmouth Ave to Ludlow Ave	7	0%	43%	0%	57%	29%	29%	29%	14%	0%
MLK Dr: Central Pkwy to Hopple St	70	3%	26%	10%	61%	30%	36%	19%	10%	6%
Colerain Ave: Central Ave to McMicken Ave	1	0%	100%	0%	0%	0%	0%	0%	0%	100%
Clay Wade Bailey Bridge	13	8%	8%	31%	54%	0%	46%	31%	15%	8%

Intersections

The 5-year intersection crashes (2019-2023) are summarized in **Table 34** (Kentucky) and **Table 35** (Ohio). The intersections summarized in these tables include the IMS limits for the full BSB project corridor. For Kentucky, the intersection of Dixie Hwy & Kyles Lane, Main Street & 4th Street, and Philadelphia and 4th Street generate the highest crash totals. In Ohio, all intersection crash frequencies are below 60 crashes per intersection. The intersections of 3rd & Elm Street, and Linn & Central Parkway generate the highest crash totals.

Table 34: Kentucky Intersection Crashes

Intersection	Total Crashes	Crash Severity				Crash Type				
		K/A	B	C	PD	Rear End	Angle	Side-swipe	Single Veh	Other
NB I-71/I-75 & Dixie Hwy	10	0%	0%	0%	100%	30%	40%	30%	0%	0%
NB I-71/I-75 & Kyles Lane	30	0%	3%	3%	93%	40%	23%	10%	3%	23%
SB I-71/I-75 & Dixie Hwy	18	0%	11%	11%	78%	50%	39%	6%	0%	6%
SB I-71/I-75 & Kyles Lane	22	0%	5%	0%	95%	68%	18%	0%	0%	14%
Dixie Hwy & Kyles Lane	122	0%	7%	7%	87%	44%	16%	16%	4%	19%
Main St & Pike St	14	0%	0%	7%	93%	29%	7%	43%	0%	21%
Main St & 5th St	55	0%	5%	7%	87%	16%	55%	11%	11%	7%
Main St & 4th St	85	1%	4%	5%	91%	19%	45%	19%	4%	14%
Simon Kenton & 12th St	44	0%	5%	5%	91%	18%	70%	5%	5%	2%
Philadelphia & 5th St	19	0%	0%	5%	95%	26%	32%	32%	5%	5%
Philadelphia & 4th St	68	1%	3%	4%	91%	16%	41%	34%	4%	4%
Bullock & 12th St	6	0%	0%	0%	100%	50%	0%	50%	0%	0%
Bullock & Pike St	44	0%	7%	7%	86%	20%	41%	14%	7%	18%
Crescent & 5th St	2	0%	50%	0%	50%	50%	50%	0%	0%	0%
Crescent & 4th St	7	0%	14%	0%	86%	57%	29%	0%	0%	14%
Johnson St & 5th St	14	0%	7%	7%	86%	21%	14%	43%	14%	7%
Johnson St & 4th St	36	0%	3%	11%	86%	36%	42%	17%	0%	6%
Johnson St & 3rd St	0	-	-	-	-	-	-	-	-	-
Philadelphia St & 3rd St	2	50%	0%	0%	50%	50%	0%	0%	0%	50%
Crescent & 3rd St	11	0%	0%	0%	100%	55%	27%	9%	0%	9%
Bakewell St & 5th St	14	0%	0%	7%	93%	0%	50%	50%	0%	0%
Bakewell St & 4th St	49	2%	4%	2%	92%	12%	47%	35%	2%	4%
Simon Kenton & Pike St	38	0%	8%	8%	84%	11%	45%	29%	8%	8%
Main St & 9th St	20	0%	0%	5%	95%	45%	10%	30%	10%	5%

Table 35: Ohio Intersection Crashes

Intersection	Total Crashes	Crash Severity				Crash Type				
		K/A	B	C	PD	Rear End	Angle	Side-swipe	Single Veh	Other
Central Ave & 3rd St	13	0%	0%	23%	77%	8%	69%	15%	8%	0%
Central Ave & 4th St	18	0%	11%	6%	83%	11%	33%	39%	0%	17%
Central Ave & 5th St	40	0%	10%	10%	80%	18%	33%	45%	3%	3%
Central Ave & 6th St	52	2%	8%	2%	88%	8%	25%	38%	12%	17%
Central Ave & 7th St	15	0%	33%	0%	67%	13%	33%	47%	0%	7%
Central Ave & 9th St	10	0%	10%	10%	80%	40%	40%	10%	0%	10%
Mound St & 9th St	0	-	-	-	-	-	-	-	-	-
CWB & 3rd St	0	-	-	-	-	-	-	-	-	-
Gest St & 6th St	15	0%	0%	13%	87%	33%	0%	47%	13%	7%
Elm St & 2nd St	1	0%	100%	0%	0%	0%	100%	0%	0%	0%
Race St & 3rd St	43	0%	14%	9%	77%	5%	51%	42%	2%	0%
Elm St & 3rd St	56	0%	25%	7%	68%	2%	66%	29%	0%	4%
Elm St & 4th St	26	0%	27%	19%	54%	0%	81%	8%	0%	12%
Plum St & 3rd St	3	0%	0%	0%	100%	0%	100%	0%	0%	0%
Plum St & 4th St	3	0%	67%	0%	33%	33%	33%	0%	33%	0%
Linn St & 6th St	4	0%	0%	25%	75%	0%	75%	25%	0%	0%
Linn St & 8th St	13	8%	38%	8%	46%	8%	31%	23%	8%	31%
Linn St & Court St	1	0%	0%	0%	100%	0%	100%	0%	0%	0%
Linn St & Ezzard Charles Dr	21	0%	19%	24%	57%	19%	52%	19%	0%	10%
Winchell Ave & Ezzard Charles	9	11%	0%	11%	78%	0%	56%	33%	0%	11%
Freeman Ave & Gest St	12	0%	8%	8%	83%	17%	58%	17%	0%	8%
Western Ave & Gest St	44	2%	11%	14%	73%	5%	68%	18%	7%	2%
Western Ave & Ezzard Charles	23	4%	17%	35%	43%	4%	61%	22%	4%	9%
Winchell Ave & Liberty St	31	0%	16%	13%	71%	19%	58%	16%	3%	3%
Winchell Ave & Findlay St	21	0%	38%	10%	52%	24%	52%	19%	0%	5%
Western Ave & Liberty St	26	0%	12%	12%	77%	15%	69%	12%	4%	0%
Western Ave & Findlay St	12	0%	25%	17%	58%	17%	67%	17%	0%	0%
Dalton Ave & Findlay St	11	9%	36%	9%	45%	9%	55%	9%	9%	18%
Linn St & Bank St	0	-	-	-	-	-	-	-	-	-
Linn St & Central Pkwy	57	5%	26%	16%	53%	33%	28%	18%	5%	16%
Brighton Pl & Central Ave	0	-	-	-	-	-	-	-	-	-
Brighton Pl & Central Pkwy	0	-	-	-	-	-	-	-	-	-
McMillian Ave & Central Pkwy	51	2%	22%	12%	65%	12%	63%	18%	0%	8%
Colerain Ave & Harrison St	4	0%	0%	0%	100%	0%	50%	0%	25%	25%
Patterson St & Harrison St	0	-	-	-	-	-	-	-	-	-
Winchell Ave & Bank St	10	0%	30%	10%	60%	10%	50%	10%	10%	20%
Winchell Ave & Harrison St	1	0%	0%	0%	100%	0%	0%	100%	0%	0%

Intersection	Total Crashes	Crash Severity				Crash Type				
		K/A	B	C	PD	Rear End	Angle	Side-swipe	Single Veh	Other
Spring Grove Ave & Bank St	25	4%	40%	8%	48%	8%	68%	12%	8%	4%
Spring Grove Ave & Harrison	13	0%	31%	0%	69%	23%	15%	31%	15%	15%
Spring Grove Ave & WHV	30	0%	10%	17%	73%	20%	40%	23%	7%	10%
CWB & 2nd St	1	0%	0%	0%	100%	0%	100%	0%	0%	0%
Linn St & Gest St	15	0%	20%	13%	67%	33%	60%	0%	0%	7%
Linn St & Central Ave	1	0%	0%	0%	100%	0%	100%	0%	0%	0%

Ramps

The ramp segments are summarized for Kentucky in **Table 36** and for Ohio in **Table 37**. In Kentucky, there are no crashes of severity level K/A. The SB exit to Buttermilk Pike has the highest crash totals, which are outside the project design limits. In Ohio, there are four K/A severity level crashes that occur at the SB entrance from WHV, NB exit to WHV, SB exit to Ezzard Charles, and SB I-71 to SB I-71/75 system ramp.

Table 36: Kentucky Ramps Crashes

Ramp	Total Crashes	Crash Severity				Crash Type				
		K/A	B	C	PD	Rear End	Angle	Side-swipe	Single Veh	Other
NB I-71/I-75 Exit to Buttermilk Pike	21	0%	0%	14%	86%	57%	0%	29%	14%	0%
NB I-71/I-75 Entrance from Buttermilk Pike	2	0%	0%	0%	100%	100%	0%	0%	0%	0%
SB I-71/I-75 Exit to Buttermilk Pike	55	0%	9%	7%	84%	87%	0%	9%	2%	2%
SB I-71/I-75 Entrance from Buttermilk Pike	17	0%	0%	0%	100%	35%	12%	47%	6%	0%
NB I-71/I-75 Exit to Dixie Hwy	8	0%	0%	0%	100%	88%	0%	13%	0%	0%
NB I-71/I-75 Entrance from Dixie Hwy	4	0%	25%	0%	75%	50%	0%	0%	50%	0%
SB I-71/I-75 Exit to Dixie Hwy	9	0%	0%	0%	100%	89%	0%	0%	11%	0%
SB I-71/I-75 Entrance from Dixie Hwy	2	0%	50%	0%	50%	50%	0%	0%	50%	0%
NB I-71/I-75 Exit to Kyles Ln	11	0%	0%	9%	91%	91%	0%	9%	0%	0%
NB I-71/I-75 Entrance from Kyles Ln	6	0%	0%	0%	100%	50%	0%	50%	0%	0%
SB I-71/I-75 Exit to Kyles Ln	18	0%	17%	11%	72%	67%	0%	11%	11%	11%
SB I-71/I-75 Entrance from Kyles Ln	2	0%	0%	0%	100%	0%	0%	100%	0%	0%
NB I-71/I-75 Exit to 12th St	16	0%	0%	0%	100%	38%	25%	25%	13%	0%
SB I-71/I-75 Entrance from 12th St	13	0%	0%	0%	100%	15%	8%	46%	31%	0%
NB I-71/I-75 Exit to 5th St	15	0%	0%	0%	100%	60%	13%	13%	13%	0%
NB I-71/I-75 Entrance from Pike St	12	0%	0%	0%	100%	58%	8%	33%	0%	0%

Ramp	Total Crashes	Crash Severity				Crash Type				
		K/A	B	C	PD	Rear End	Angle	Side-swipe	Single Veh	Other
SB I-71/I-75 Exit to 5th St	19	0%	5%	11%	84%	37%	16%	21%	26%	0%
NB I-71/I-75 Entrance from 4th St	8	0%	13%	0%	88%	13%	0%	50%	38%	0%
SB I-71/I-75 Exit to Pike St	1	0%	0%	0%	100%	100%	0%	0%	0%	0%

Table 37: Ohio Ramps Crashes

Ramp	Total Crashes	Crash Severity				Crash Type				
		K/A	B	C	PD	Rear End	Angle	Side-swipe	Single Veh	Other
SB I-75 Exit to Hopple Street	3	0%	33%	67%	0%	67%	0%	0%	33%	0%
SB I-75 Entrance from WB Hopple Street	6	0%	0%	0%	100%	17%	0%	17%	67%	0%
SB I-75 Entrance from EB Hopple Street	5	0%	20%	0%	80%	0%	0%	20%	80%	0%
NB I-75 Exit to Hopple Street	13	0%	0%	15%	85%	46%	0%	15%	23%	15%
SB I-75 Exit to WHV	5	0%	40%	0%	60%	60%	0%	0%	40%	0%
SB I-75 Entrance from WHV	8	13%	13%	13%	63%	13%	0%	38%	38%	13%
NB I-75 Exit to WHV	4	0%	0%	0%	100%	50%	0%	25%	0%	25%
NB I-75 Entrance Ramp from Winchell Ave/WHV	34	3%	12%	9%	76%	44%	3%	9%	35%	9%
SB I-75 Exit to Findlay Street	7	0%	0%	0%	100%	57%	0%	0%	43%	0%
SB I-75 Exit to Ezzard Charles	4	25%	0%	0%	75%	25%	0%	25%	25%	25%
NB I-75 Entrance from Ezzard Charles	4	0%	0%	0%	100%	50%	0%	25%	25%	0%
SB I-75 Exit to Gest Street	0	-	-	-	-	-	-	-	-	-
NB I-75 Entrance from Gest Street	3	0%	33%	0%	67%	0%	0%	100%	0%	0%
NB I-75 Entrance from Winchell Ave (n/o 8th Street)	1	0%	100%	0%	0%	100%	0%	0%	0%	0%
SB I-75 Exit to 7th Street	1	0%	0%	0%	100%	100%	0%	0%	0%	0%
SB I-75 Entrance from 8th Street	1	0%	0%	100%	0%	0%	0%	0%	100%	0%
SB I-75 Exit to 5th Street	3	0%	33%	0%	67%	33%	0%	0%	67%	0%
NB I-75 Entrance from 4th Street	0	-	-	-	-	-	-	-	-	-
SB I-75/US-50 EB Exit to 2nd Street	0	-	-	-	-	-	-	-	-	-
NB I-75 Exit to 5th Street	3	0%	0%	0%	100%	0%	0%	100%	0%	0%
NB I-71/I-75 System Ramp to NB I-71	54	0%	15%	4%	81%	15%	2%	48%	26%	9%
NB I-71 Exit to 2nd Street	0	-	-	-	-	-	-	-	-	-
SB I-75 to NB I-71 System Ramp	23	0%	4%	13%	83%	48%	0%	35%	17%	0%
SB I-71 to SB I-71/I-75 System Ramp	61	2%	11%	11%	75%	41%	0%	38%	18%	3%
SB I-71 to NB I-75 System Ramp	10	0%	10%	10%	80%	20%	20%	40%	10%	10%
NB I-75 to US-50 WB	1	0%	100%	0%	0%	100%	0%	0%	0%	0%
SB I-71 to US-50 WB	3	0%	0%	33%	67%	0%	0%	100%	0%	0%
EB US-50 to 5th Street	6	0%	17%	17%	67%	17%	0%	33%	17%	33%
EB US-50 to SB I-71/I-75	0	-	-	-	-	-	-	-	-	-
EB US-50 to NB I-71	18	0%	17%	6%	78%	28%	0%	6%	56%	11%

Ramp	Total Crashes	Crash Severity				Crash Type				
		K/A	B	C	PD	Rear End	Angle	Side-swipe	Single Veh	Other
WB US-50 Exit to 5th St	0	-	-	-	-	-	-	-	-	-
WB US-50 Exit to NB I-71	0	-	-	-	-	-	-	-	-	-
NB I-71/I-75 Exit to WB US-50	15	0%	20%	13%	67%	13%	0%	0%	73%	13%
SB I-75 Exit to 2nd St	3	0%	0%	0%	100%	33%	0%	67%	0%	0%
NB I-75 Entrance from Hopple Street	3	0%	33%	33%	33%	33%	0%	0%	67%	0%
NB I-75 Exit to I-74	8	0%	0%	25%	75%	25%	13%	25%	13%	25%
SB I-75 Entrance from Western Ave	1	0%	100%	0%	0%	100%	0%	0%	0%	0%
EB US-50 Exit to 2nd St	2	0%	0%	0%	100%	50%	0%	50%	0%	0%

7. PREDICTIVE SAFETY ANALYSIS

7.1 Methodology

FHWA's Interactive Highway Safety Design Model (IHSDM) quantitatively evaluates the safety effects of highway geometric designs by calculating a predicted crash frequency. The Refined Alternative I (Concept I-W) and Build Innovations are evaluated for Phase III and II project limits, with traffic volume and design differences. The Phase I project limits have no design differences and nominal volume differences between the alternatives. The predictive crash frequencies are compared for the project limits by facility type, and then a micro evaluation is provided for facilities related to each design innovation.

The IHSDM modeling considers many geometric and traffic-related inputs for its predictive model, including:

- Lane width
- Shoulder width (outside and inside)
- Number of Lanes
- Facility Type
- AADT
- High hour volume proportion (uses IHSDM built-in function)
- Horizontal Curves
- Barrier Type and presence
- Median Type and presence
- Ramp density
- Turn lanes at intersections
- Traffic signal control

These design elements are used to derive the predictive crash frequencies for the alternatives. Part C of the Highway Safety Manual (HSM) offers two types of procedures for predicting crashes, listed below:

- Predictive Method: The predictive crash method uses HSM formulas, SPFs, and CMFs to estimate "predicted crashes." Observed crash data is not needed with this procedure.
- Empirical-Bayes (E-B) Method: The E-B method uses existing crash data in tandem with HSM formulas to estimate "expected crashes."

For this study, the E-B method was not applicable due to capacity and extensive geometric changes, so the predictive method was used with default calibration parameters. Calibration factors specific to ODOT and KYTC were not available for this analysis. Due to this limitation, the predictive results should be considered in terms of relative differences. Additionally, directly comparing predicted and observed crashes, as summarized in Section 6, is not advisable.

Two modeling methods are available in the IHSDM to perform a predictive crash analysis: station-based methodology and site-based methodology. The station-based method allows for the automatic segmentation of roadway elements and allows the design to be viewed in the highway viewer application within the software. This methodology is generally best for use when comparing design alternatives and when detailed highway geometry data is available and the study area is larger than only a few roadway elements. The site-based method is usually better for evaluating individual intersections or small segments of highways where detailed stationing and horizontal design data are unavailable. The HSM methodology does not account for vertical design elements and is not included in this modeling. There may be additional safety benefits from improvements to vertical sight and clearance. For this study, the station-based methodology was initiated by developing and importing an I-71/75 mainline alignment file covering the limits of the analysis.

Two user-defined crash modification factors (CMFs) are used in the IHSDM models, listed below:

- High Volume 2 Lane CD Roads – A variable CMF is used for 2-lane C-D roads with volume outside the calibration range of 32,000. The analyst found that the 2-lane C-D road function has a steep increase in crash frequency outside this range, while other safety performance functions are near a linear function beyond the calibration range. Therefore, the CMF accounts for additional forecasted vehicles not specifically entered into the model. This is not a CMF in the traditional sense, but merely a modelling technique to account for HSM limitations.
- Roundabout—In the Innovations model, a CMF[1] of 0.29 for K, A, B, and C type crashes and a CMF[2] of 0.74 for PD type crashes is applied to the signalized ramp terminals at Dixie Hwy and Kyles Lane and the Crescent St/3rd St roundabout to model the proposed roundabout configurations. These factors are used in the model because roundabouts cannot be analysed directly with the software.

[1] https://cmfclearinghouse.fhwa.dot.gov/detail.php?facid=4195
[2] https://cmfclearinghouse.fhwa.dot.gov/detail.php?facid=4196

The predictive crash frequencies summarized in this report are based on a 20-year analysis using the opening year 2029 and design year 2049 traffic volumes. The crash costs summaries are based on ODOT 4-code economic unit costs published in May 2024. These costs convert the predicted crash frequencies by severity to total safety costs. The cost values are:

- K/A: $502,809
- B: $72,068
- C: $48,848
- PD: $11,008

Certain roadway elements within the default predictive module of IHSDM provide predicted crashes as split between FI and PDO rather than detailing the full KABCO breakdown. In these instances, the standard conversion from FI to KABC crashes is utilized and is not impacted by facility type. The conversion for roadway elements and intersection elements are provided below:

Roadway alignment conversions:

- K = FI * 0.002575
- A = FI * 0.053525
- B = FI * 0.276415
- C = FI * 0.667485

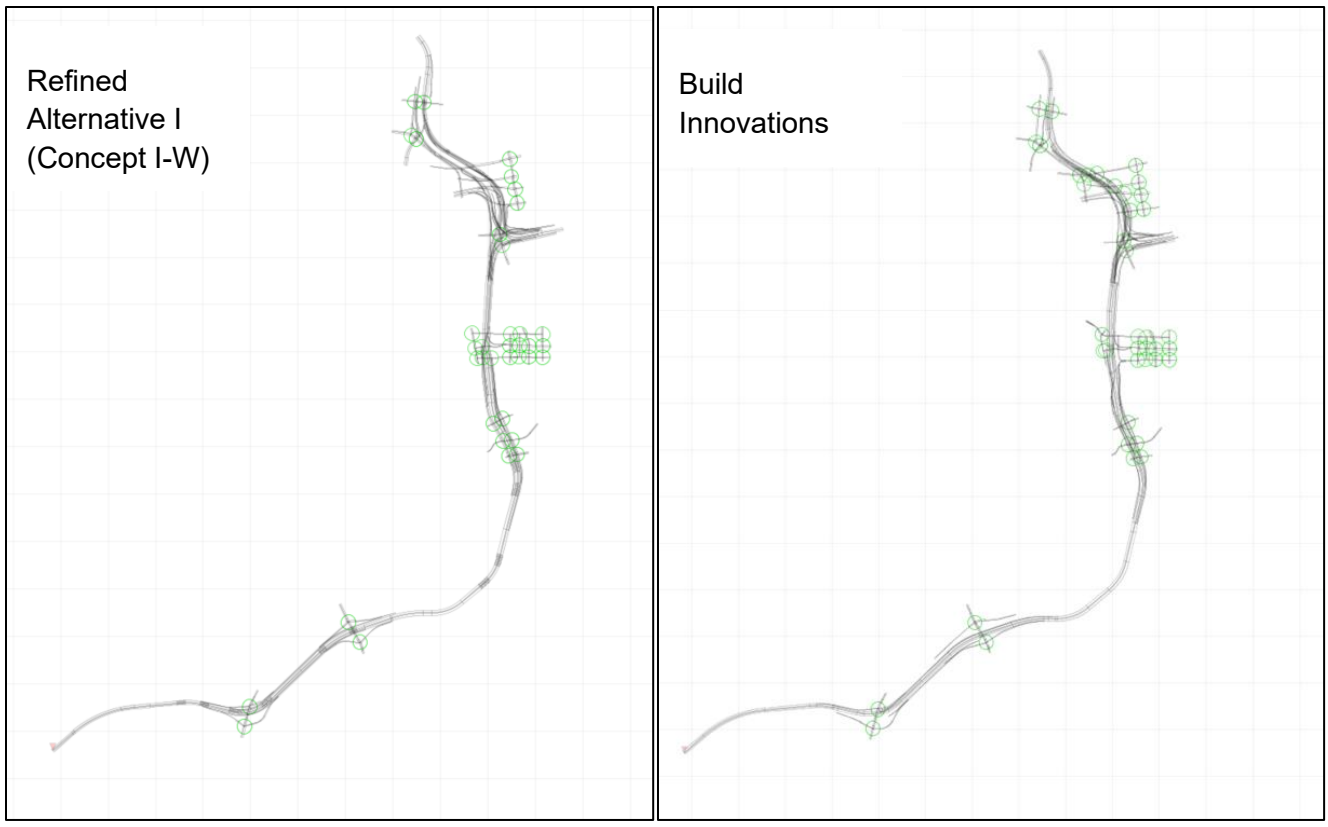
Intersection conversions:

- K = FI * 0.0146
- A = FI * 0.0448
- B = FI * 0.2469
- C = FI * 0.6917

7.2 Predictive Crash Results – Analysis Limits

The I-71/I-75 Phase II and III limits are evaluated with IHSDM predictive safety analysis to quantify anticipated changes to crash frequencies between the two alternatives. The analysis captures the freeway mainline crashes between Buttermilk Pike on the southern limits and Ezzard Charles on the northern limits. The project innovations do not change the geometry north of Ezzard Charles between the two alternatives. The freeway ramps, ramp terminal intersections, and arterial intersections within these limits are also included. **Figure 14** shows the IHSDM model extents for the I-71/I-75 corridor.

Figure 14: BSB Phase II and III IHSDM Model Limits



A summary of the crash totals by severity for the freeway mainline, C-D Roads & ramps, arterials, and intersections are summarized in **Table 38.**

Table 38: 20-Year Predicted Crashes for BSB Project Phase II and III Limits

Alternative	Facility	Predicted Crashes: 2029-2049						20-Year
		K	A	B	C	PD	Total	Crash Cost ($Million)
Refined Alternative I (Concept I-W)	Freeway Mainline	26.5	73	500	1375	4832	6807	$206.6
	C-D Roads & Ramps	15.8	48	272	645	1470	2450	$99.3
	Arterials	2.3	13	64	139	486	705	$24.6
	Intersections	1.4	31	163	508	1766	2470	$72.2
	Total	46.0	165	1000	2668	8554	12432	$402.6
Build Innovations	Freeway Mainline	25.5	71	484	1418	4635	6633	$203.6
	C-D Roads & Ramps	18.9	57	323	777	1696	2872	$118.2
	Arterials	2.5	15	71	145	496	730	$26.7
	Intersections	1.3	33	172	447	2101	2756	$74.9
	Total	48.5	177	1051	2787	8929	12992	$423.4

Overall, the crash totals for the two alternatives are very similar. Build Innovations reduces the crash costs for the freeway mainline by incorporating wider cross sections at the Companion Bridge, and improving the southern terminus of the project near Dixie Hwy. The arterial and intersection crashes are higher in the Build Innovations due to the increase in arterial roadways. Many traffic movements in Ohio, which are served with direct ramps in Refined Alternative I (Concept I-W), are provided through intersections with Build Innovations. Build Innovation design refinements achieve other project objectives, such as reducing right-of-way impacts and enhancing pedestrian accommodations, but additional intersections do lead to increased vehicle conflict, which is one trade-off with the design changes. The increase in arterial crashes is mitigated by designing intersections in accordance with FHWA's proven safety countermeasures for intersections[3]. These guidelines highlight the value of roundabouts, dedicated left and right turn lanes, yellow change intervals, leading pedestrian intervals, crosswalk visibility enhancements, and medians with pedestrian refuge islands. These strategies are implemented at the new intersection in Build Innovations. The use of these best design methods is not specifically accounted for in the IHSDM modeling, so additional safety reductions for the Build Innovations alternative are anticipated.

The other difference in the predictive results indicates an increase in crash costs for the Build Innovations C-D roads and ramps. Design enhancements convert some 1-lane C-D roads to 2-lane C-D roads, which have safety performance functions with a higher crash frequency. Additionally, C-D road gore points were optimized, leading to more C-D road length in Build Innovations, and C-D road crash rates from IHSDM are higher than freeway mainlines. The design changes aim to improve operations during peak periods, and some changes are necessary to achieve constructability and other design requirements. **Table 39** summarizes the predicted crashes by IHSDM facility type. Key facility type descriptors are: EX = Exit Ramp, EN = Entrance Ramp, U = Undivided Highway, O = One-Way Arterial, F = Freeway, SG = Signal, ST = Stop, D4 = 4-legged ramp

[3] https://highways.dot.gov/safety/proven-safety-countermeasures

terminal. The numbers tied to these descriptors indicate the number of lanes for road segments or the number of legs for intersections.

Table 39: 20-Year Predicted Crashes by IHSDM Facility Type

Alternative	Facility Type	Facility Type	Predicted Crashes: 2029-2049					
			K	A	B	C	PD	Total
Refined Alternative I (Concept I-W)	Highway	1EX	1.3	4	17	26	50	99
		2EN	0.1	0	2	6	15	24
		1EN	1.5	5	31	54	95	186
		4U	1.0	3	17	47	144	211
		1CD	3.0	9	60	107	216	395
		2U	0.3	1	5	13	42	61
		2O	0.9	9	39	72	276	397
		2CD	9.8	30	161	452	1093	1746
		3O	0.1	1	4	7	24	36
		4O	0.0	0	0	0	0	0
		6F	10.4	29	196	579	2112	2926
		8F	7.9	22	150	434	1452	2066
		10F	8.3	23	154	362	1268	1815
	Intersection	4SG	0.74	15	81	191	1014	1302
		3ST	0.13	3	11	25	87	126
		3SG	0.04	1	5	13	46	64
		5SG	0.10	2	11	27	142	182
	Ramp Terminals	D4	0.4	9	56	253	478	796
	Total		46.0	165	1000	2668	8554	12432
Build Innovation	Highway	1EX	1.1	3	14	25	45	89
		2EN	0.0	0	0	1	2	3
		1EN	2.3	7	46	81	152	288
		4U	0.8	2	13	37	113	165
		1CD	2.4	7	48	77	166	301
		2U	0.5	1	8	21	69	100
		2O	0.5	5	23	42	159	229
		2CD	13.1	40	215	593	1330	2191
		3O	0.5	4	18	29	109	161
		4O	0.3	2	10	16	48	76
		6F	2.7	7	51	104	362	527
		8F	14.9	42	284	921	2951	4213
		10F	7.9	22	149	392	1322	1893
	Intersection	4SG	0.9	20	103	243	1235	1603
		3ST	0.1	3	11	27	118	159
		3SG	0.1	1	6	14	55	76
		5SG	0.3	7	34	82	312	435
	Ramp Terminals	D4	0.1	3	18	81	382	484
	Total		48.7	182	1083	2926	8951	13192

7.3 Ohio Innovations

This section summarizes the safety impacts of four Ohio design innovations. These innovations include:

1) SB I-75 Roadway Reconfiguration
2) Combination of 2nd and 3rd Street Connections
3) US-50 Roadway Consolidation
4) The Realization of the Street Grid

Predictive safety analysis was completed for each innovation's road segments and intersections, providing a quantitative crash comparison between Refined Alternative I (Concept I-W) and Build Innovations.

Ohio Innovation 1 – SB I-75 Roadway Reconfiguration

The reconfiguration of the SB I-75 through lanes and the CD SB exits resulted in the removal of the curve immediately north of the proposed bridge entry point and an increase in the radius of the upstream curve (near US 50 to W 3rd Street) (see **Figure 15**). The changes to the CD SB lanes related to the swap with SB I-75 do not result in anticipated safety impacts compared to Refined Alternative I (Concept I-W) based on similar geometry and traffic patterns across both alternatives. The anticipated impact is verified through an IHSDM predictive analysis. The IHSDM predictive analysis for Ohio Innovation 1 evaluates the I-75 mainline and SB I-75 C-D road between the Ohio River and Ezzard Charles. The predictive crash analysis for these segments is summarized in **Table 40**. The results show that Build Innovations has a slight improvement in the corridor safety related to Innovation 1.

Table 40: 20-year Predicted Crashes for Ohio Innovation 1

Alternative	Facility	Predicted Crashes: 2029-2049						Crash Cost ($ Million)
		K	A	B	C	PD	Total	
Refined Alternative I (Concept I-W)	I-75 Mainline	2.0	6	37	77	276	397	13.2
	I-75 SB C-D	0.5	1	8	22	63	95	$3.3
	Total	3.5	10	64	148	522	747	$16.5
Build Innovations	I-75 Mainline	1.8	5	33	63	226	329	$11.2
	I-75 SB C-D	0.5	2	9	25	78	114	$3.8
	Total	2	6	41	88	305	443	$15.0

Figure 15: SB I-75 Roadway Reconfiguration

Ohio Innovation 2 – Combination of 2nd and 3rd Street Connections

Consolidating the 2nd and 3rd Street ramps expands on the proposed CD exit ramp in Refined Alternative I (Concept I-W) (see **Figure 16**). While the Build Innovations design increases the volume of traffic, lanes, and potential conflict points through the 2nd and 3rd Street intersections, these are mitigated with signal coordination and phasing. At Clay Wade Bailey and W 3rd Street, the increase in traffic is the SB through movement (6,250 daily vehicle increase in year 2049), which will be mitigated with protected left turn-only signal phasing for the corresponding NB left movement. Southbound right turn traffic movements at the intersection of Clay Wade

Bailey and W 3rd Street do not increase for Build Innovations compared to Refined Alternative I (Concept I-W). Northbound right-turn volumes have increased by approximately 20%. The redesigned pedestrian island on the north side of the intersection will enable the use of Leading Pedestrian Interval (LPI) timing in the signal design. This will help separate the timing of pedestrian and vehicular movements. The Clay Wade Bailey and 2nd Street intersection will be signalized with full pedestrian signals, phasing, and accommodations to overcome the increase in anticipated left-turning movements with the Build Innovations alternative. The southbound left-turning movement will operate on a protected-only phase, eliminating the need for left turns to yield to pedestrians, which is a feature present in Refined Alternative I (Concept I-W).

Figure 16: Combination of 2nd and 3rd Street Connections

A predictive crash analysis is completed to understand the anticipated impact on crash frequency with the design innovation. The analysis includes the I-75 SB exit ramps to 2nd and 3rd Street and the CWB intersections at 3rd and 2nd Street. The analysis indicates an increase in crashes for Build Innovations, with more crashes on the exit to 3rd Street due to volume increases, plus an increase in crashes at the 2nd and 3rd Street intersections. These crashes may be minimized by using FHWA's proven safety countermeasures at the signalized intersections. The safety measures that will be considered in the final design include:

- Leading Pedestrian Interval that is expected to reduce pedestrian-vehicle crashes by 13%[4]
- Pedestrian refuge island on the north leg that is expected to reduce pedestrian-vehicle crashes by 56%[5]

The predictive safety results do not capture the use of these safety measures.

Table 41: 20-year Predicted Crashes for Ohio Innovation 2

Alternative	Facility	Predicted Crashes: 2029-2049						Crash Cost ($ Million)
		K	A	B	C	PD	Total	
Refined Alternative I (Concept I-W)	SB I-75 Exit to 2nd Street	0.4	1	7	20	62	91	$3.1
	SB I-75 Exit to 3rd Street	0.0	0	1	1	2	3	$0.2
	CWB & 2nd Street Intersection	0.0	0	1	1	5	7	$0.3
	CWB & 3rd Street Intersection	0.0	1	3	6	47	57	$1.3
	Total	0.5	2	11	28	116	158	$4.8
Build Innovations	SB I-75 Exit to 3rd Street	1.0	3	15	35	77	132	$5.6
	CWB & 2nd Street Intersection	0.0	0	1	2	14	17	$0.5
	CWB & 3rd Street Intersection	0.2	4	22	54	185	265	$8.5
	Total	1.2	8	39	91	276	414	$14.7

[4] https://highways.dot.gov/safety/proven-safety-countermeasures/leading-pedestrian-interval

[5] Medians and Pedestrian Refuge Islands in Urban and Suburban Areas | FHWA

Ohio Innovation 3 – US-50 Roadway Consolidation

The consolidation of US-50 (**Figure 17**) offers slightly increased radii compared to Refined Alternative I (Concept I-W). Refined Alternative I (Concept I-W) includes a lane drop where US-50 EB merges with the CD road at W 2nd Street. This requires drivers to assess the merge over their right shoulder towards the outside of the curve, expanding the driver's blind spot. This lane drop is removed in Build Innovations. Build Innovations adds a different lane drop from the CD road SB into US-50 EB as it merges into I-71 NB; however, this merge is outside the curve, where the driver's vision is not compromised. The IHSDM predictive results indicate a small safety improvement with Build Innovations as summarized in **Table 42**.

Figure 17: US-50 Roadway Consolidation

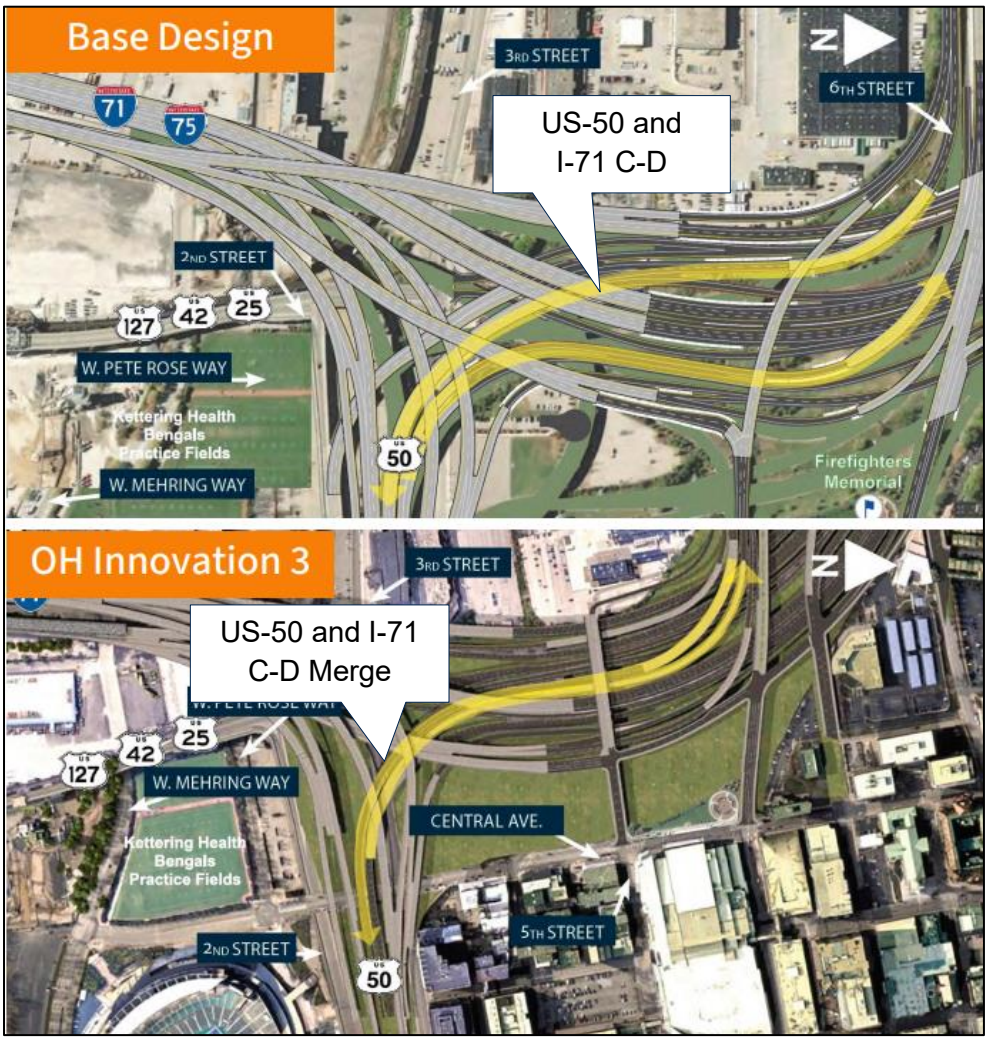


Table 42: 20-year Predicted Crashes for US-50

Alternative	Predicted Crashes: 2029-2049						Crash Cost ($ Million)
	K	A	B	C	PD	Total	
Refined Alternative I (Concept I-W)	1.5	5	26	65	151	248	$9.8
Build Innovations	1.2	4	20	54	132	211	$8.0

Ohio Innovation 4 – The Realization of the Street Grid

Ohio Innovation 4 (**Figure 18**) includes new at-grade intersections utilizing one-way pairs for the NB CD exit ramp. The new intersections introduce additional conflict points within the project limits. Using one-way pairs limits left-turn conflicts, eliminating the most serious conflict points while offering opportunities to accommodate pedestrians and cyclists through the interchange area safely. The new NB arterial has three lanes at the 5th Street intersection and four at the 6th and 7th Street intersections.

In addition to the NB arterial, an at-grade intersection was created at the Gest Street and 8th Street intersection. This new intersection offers improved accommodations for pedestrians and cyclists by introducing an at-grade intersection instead of fly-over ramps. To mitigate the increased conflicts introduced with the improved access, protected left turn signal phasing, pedestrian refuge islands, leading pedestrian intervals, and dedicated right turn lanes on EB and SB approaches will minimize crashes that may occur due to additional conflict points.

An IHSDM model is developed to analyze ramps and intersections associated with the realization of the street grid innovation to quantify the differences in predicted crashes. This model includes service ramps and arterial intersections within and adjacent to the design limits. The IHSDM results are summarized in **Table 43.** The modeling shows an increase in predicted crashes due to the introduction of new at-grade intersections.

Figure 18: Realization of the Street Grid

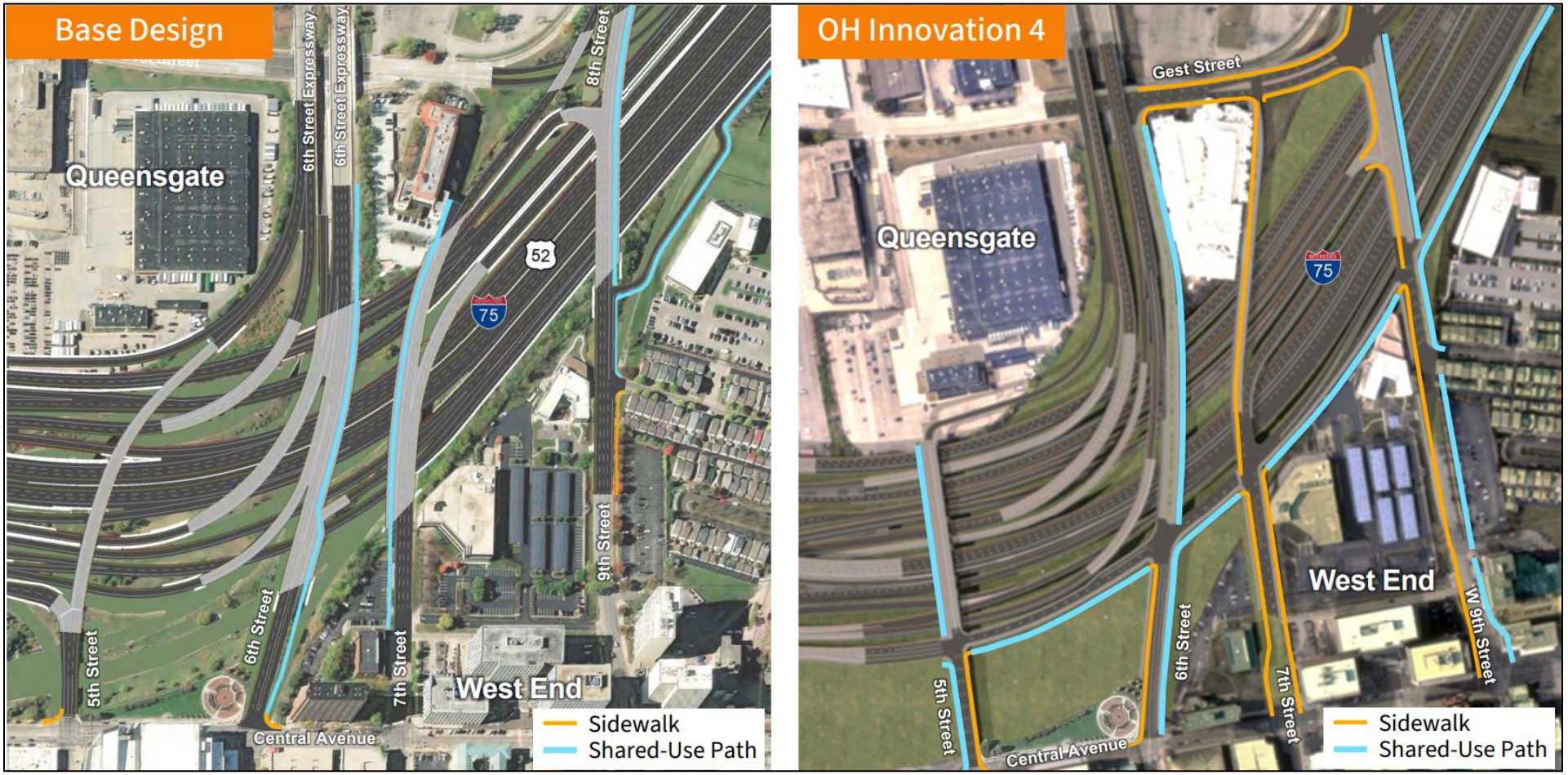


Table 43: 20-year Predicted Crashes for Ohio Innovation 4

Alternative	Facility	Predicted Crashes: 2029-2049						Crash Cost ($ Million)
		K	A	B	C	PD	Total	
Refined Alternative I (Concept I-W)	NB Exit to 5th Street	0.1	0	1	3	8	12	$0.4
	NB Entrance from 6th Street	0.1	0	2	4	9	16	$0.7
	SB Exit to 7th Street	0.9	3	15	43	109	171	$6.2
	US-50 EB to 5th Street	0.1	1	3	5	21	29	$1.0
	Central Avenue & 5th Street Int.	0.0	1	4	10	54	70	$1.8
	Central Avenue & 6th Street Int.	0.0	1	4	10	57	73	$1.9
	Central Avenue & 7th Street Int.	0.0	1	4	10	56	71	$1.8
	Central Avenue & 9th Street Int.	0.0	1	4	9	52	66	$1.7
	NB I-75 Intersection at 5th Street	0.0	0	1	2	10	13	$0.4
	Total	1.3	7	39	96	376	519	$16.1
Build Innovations	NB Exit to 5th Street	0.1	0	3	7	23	33	$1.1
	NB Entrance from 6th Street	0.1	1	6	12	42	60	$2.0
	SB Exit to 7th Street	0.7	2	12	33	65	113	$4.6
	US-50 EB to 5th Street	0.1	1	2	4	16	23	$0.9
	Central Avenue & 5th Street Int.	0.1	1	6	13	68	88	$2.4
	Central Avenue & 6th Street Int.	0.0	1	5	12	68	87	$2.3
	Central Avenue & 7th Street Int.	0.1	1	6	14	85	106	$2.6
	Central Avenue & 9th Street Int.	0.0	1	4	9	36	51	$1.6
	NB I-75 Intersection at 5th Street	0.0	1	4	8	31	43	$1.4
	NB Arterial & 6th Street Int.	0.0	1	5	12	68	87	$2.3
	NB Arterial & 7th Street Int.	0.1	1	6	14	85	106	$2.6
	NB Arterial & 9th Street Int.	0.0	1	4	10	38	53	$1.6
	Gest & 8th Street Int	0.0	1	3	8	26	38	$1.3
	Gest & 7th Street Int.	0.0	0	1	4	38	44	$0.9
	Total	1.4	13	67	160	690	931	$27.4

7.4 Kentucky Innovations

This section summarizes the safety impacts of three Kentucky design innovations and one detailed design modification. These design changes include:

1) Vertical Profile Optimization that results in the closure of 5th Street under I-71/75
2) Pike Street access optimization that eliminates direct interstate access at 9th Street and maintains existing access at Pike Street
3) Cut in the Hill Alignment Shift
4) Roundabouts

Kentucky Innovation 1: Vertical Profile Optimization

The Build Innovations improve the corridor's visual impact, geometry, and transitions. By reconfiguring the ramps shown in **Figure 19,** the overall height of the interchange was reduced by approximately 20 feet. The total bridge area and structure heights were reduced significantly, leading to reduced costs. The transition between the C-D and frontage roads was improved and aligned more with each roadway's function. The simplified geometry provides consistent vertical grade into the companion bridge and moves the successive curves away from the bridge. While IHSDM cannot capture the safety benefit of vertical profile optimization directly, there are considerable improvements to constructability and costs, providing safety benefits by improving horizontal geometry and transitions.

For Innovation 1, the right-hand exit from the C-D Road converts to a left-hand exit. Access to 5th Street is only provided eastbound after exiting I-71/75, with 5th Street closed between Crescent Avenue and C-D road. Traffic from the southbound C-D Road has the right of way into an added lane, and the northbound C-D Road will have stop control. While it is generally not recommended to have left-hand exits for high-speed ramp terminals, they are acceptable for C-D roads due to the lower-speed characteristics of the collected traffic destined for local streets. Separating local traffic from the interstate improves the traffic flow and increases capacity by separating the high-speed traffic from the lower-speed local traffic. The predictive analysis completed for network elements associated with this innovation suggests a minor safety benefit for Build Innovations as summarized in **Table 44**.

Figure 19: Vertical Profile Optimization

Table 44: 20-year Predicted Crashes for Kentucky Innovation 1

Alternative	Facility	Predicted Crashes: 2029-2049						Crash Cost ($ Million)
		K	A	B	C	PD	Total	
Refined Alternative I (Concept I-W)	SB CD Road	0.6	2	11	24	85	123	$4.0
	5th Street Exit	0.1	0	1	1	3	6	$0.4
	4th and Philadelphia Int.	0.0	1	4	10	54	69	$1.8
	5th & Philadelphia Int.	0.0	1	3	8	44	56	$1.5
	3rd & Philadelphia Int.	0.0	1	4	9	25	39	$1.4
	3rd & Crescent Int.	0.0	1	4	10	39	54	$1.6
	4th & Crescent Int.	0.0	1	4	9	25	38	$1.3
	5th & Crescent Int.	0.0	0	1	1	8	11	$0.4
	Total	0.87	6	32	72	283	394	$12.3
Build Innovations	SB CD Road	0.5	1	10	21	68	101	$3.4
	5th Street Exit	0.1	0	1	2	4	8	$0.5
	4th and Philadelphia Int.	0.0	1	4	10	55	69	$1.8
	5th & Philadelphia Int.	0.0	1	3	8	41	53	$1.4
	3rd & Philadelphia Int.	0.0	1	4	9	27	41	$1.4
	3rd & Crescent Int.	0.0	0	4	9	27	41	$0.7
	4th & Crescent Int.	0.0	0	0	1	2	3	$0.2
	Total	0.8	4	25	54	224	308	$9.5

Kentucky Innovation 2: Pike Street Access Optimization

In Build Innovations, the at-grade intersection and access at Simon Kenton Way and Pike St from the Refined Alternative I (Concept I-W) are still proposed. The difference is that there is no longer an at-grade intersection for northbound Simon Kenton Way and 9th Street. This will maintain the condition at 9th Street and avoid adding conflict points, resulting in a safety benefit. The predictive analysis for this innovation is summarized in **Table 45**.

Figure 20: Pike Street Access Optimization

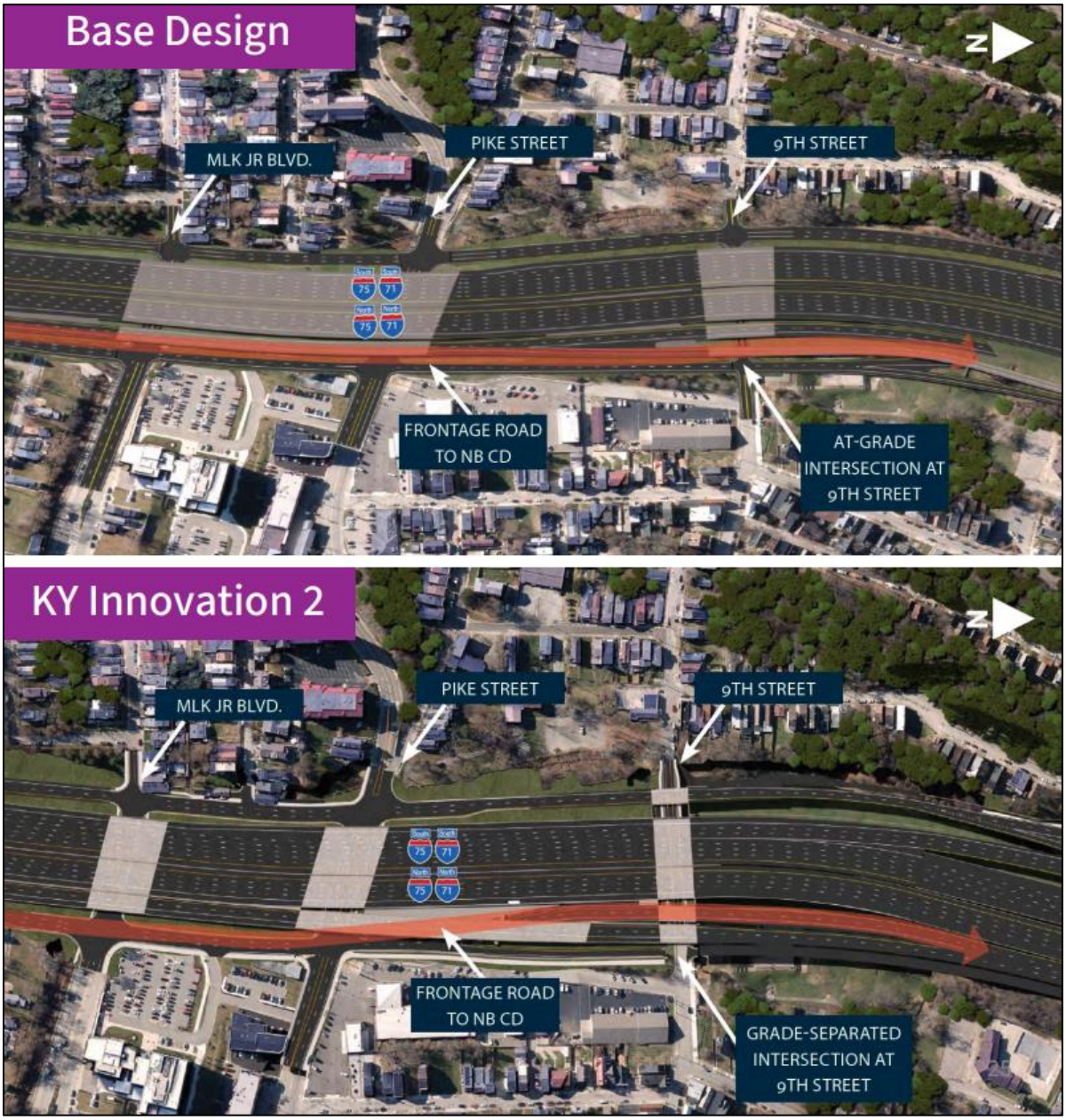


Table 45: 20-year Predicted Crashes for Kentucky Innovation 2

Alternative	Facility	Predicted Crashes: 2029-2049						Crash Cost ($ Million)
		K	A	B	C	PD	Total	
Refined Alternative I (Concept I-W)	Simon Kenton	0.1	0.6	3.9	7.7	24.3	37	$1.3
	Pike Street & Simon Kenton	0.1	1.3	6.7	15.6	81.1	105	$2.8
	9th Street & Simon Kenton	0.0	0.5	2.0	5.6	27.5	36	$1.0
	Total	0.2	2.4	13	28.9	132.9	177	$5.1
Build Innovations	Simon Kenton	0.1	0.4	2.1	4.0	13.6	20	$0.74
	Pike Street & Simon Kenton	0.0	0.8	4.4	10.2	52.3	67.7	$1.8
	9th Street & Simon Kenton	0.0	0.4	2.0	4.7	23.4	30.4	$0.8
	Total	0.1	1.6	8.5	18.8	89.2	118.2	$3.4

Kentucky Innovation 3: Cut In the Hill Alignment Shift

The Build Innovations did not hold the southeast edge of the pavement. Instead, the team evaluated the impacts on the hillside and determined a more cost-effective solution. The alignment was adjusted slightly to balance the impacts on both sides of the interstate in this area. The shift in alignment included increasing the centerline radius near station 496 to 1850'. Increasing radii on a curved roadway segment can improve safety by reducing all crash types, especially lane departures. The predictive safety analysis summarized in **Table 46** indicates a minor safety benefit for this innovation.

Figure 21: Cut in the Hill Alignment Shift

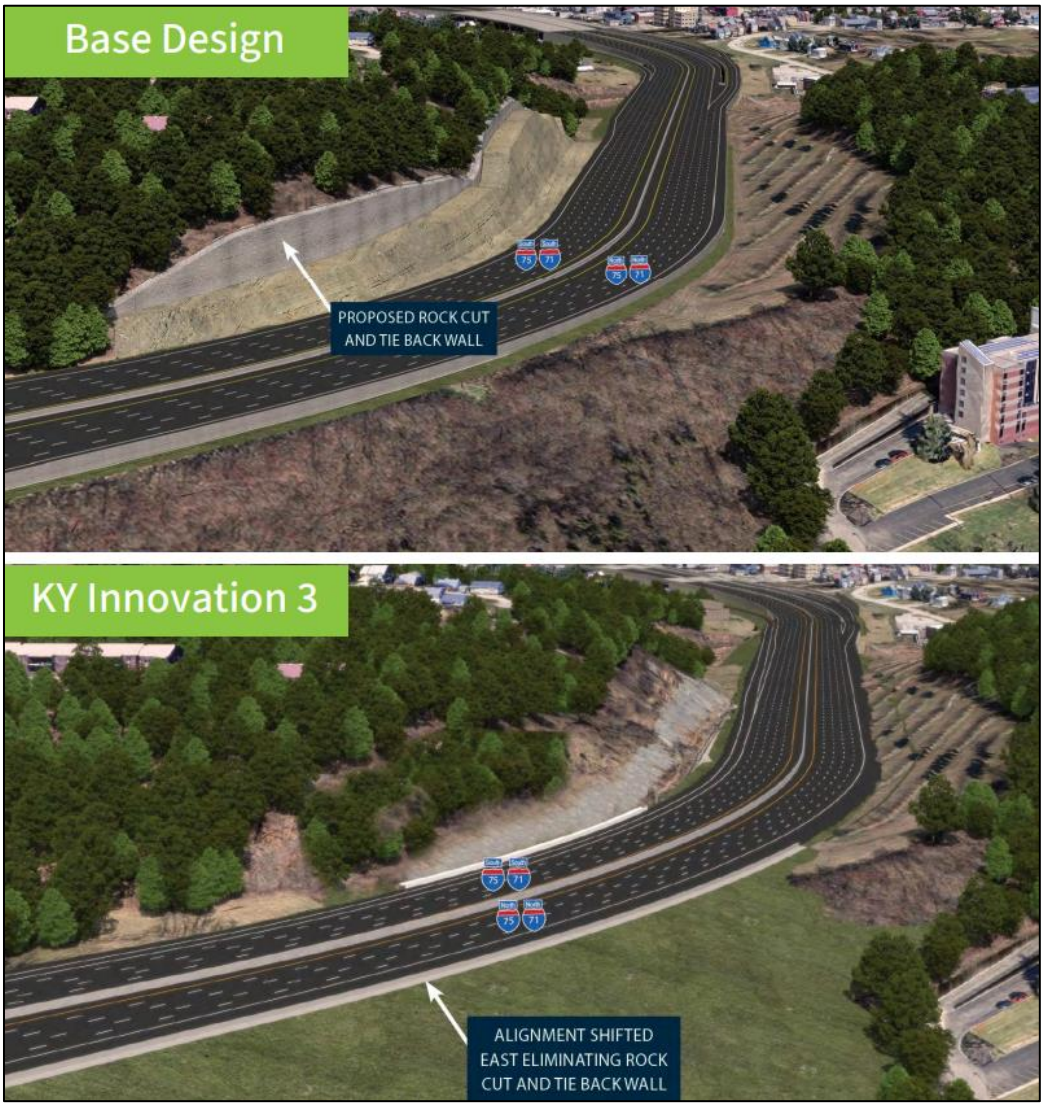


Table 46: 20-year Predicted Crashes for Kentucky Innovation 3

Alternative	Facility	Predicted Crashes: 2029-2049						Crash Cost ($ Million)
		K	A	B	C	PD	Total	
Refined Alternative I (Concept I-W)	I-71/I-75 Mainline Between Kyles and 12th Street	7.6	21	142	355	1278	1804	$56.0
Build Innovations	I-71/I-75 Mainline Between Kyles and 12th Street	7.2	20	135	365	1243	1769	$54.8

Detailed Design Modifications: Roundabouts

FHWA has identified roundabouts as a proven safety countermeasure due to their effectiveness in reducing roadway fatalities and serious injury crashes. The channelized, curved approaches require vehicles to reduce speed as they enter the roundabout, resulting in less severe collisions. Also, reduced speed allows drivers more reaction time to other vehicles or pedestrians. Converting a traditional signalized intersection to a roundabout minimizes conflict points from 32 to 8, lowering the chances of a severe crash. The crossing conflict points, which typically result in the most severe crashes, are eliminated with a roundabout. Left-hand, right-angle, and head-on crashes are generally eliminated, leaving rear-end or sideswipe crashes as the typical crash type. This lower speed and reduced conflict point environment is more accommodating to bicyclists and pedestrians. A bicyclist or pedestrian can cross one direction of travel at a time compared to crossing two directions of travel at a traditional intersection. Typically, a roundabout effectively reduces delay and queuing, resulting in improved traffic flow compared to a traditional intersection. Roundabouts provide an environmental benefit by reducing stop-and-go traffic, leading to lower vehicle idling time and fewer emissions. Roundabouts effectively transition traffic from high-speed to low-speed environments such as interchange ramp terminals. The BSB Corridor project has proposed a roundabout at Crescent Avenue and 3rd Street, and Kyles Lane and Dixie Hwy interchange ramp terminals (see **Figure 22**). Crash modification factors were provided from ODOT for conversion of signalized intersections into single- or multi-lane roundabouts. The provided crash modification factor for type K, A, B and C crashes is .29 and the crash modification factor provided for PD crashes is .74. For predictive crash analysis, these CMFs are implemented in IHSDM as a user-defined CMF by severity type. The interchange ramp terminals are modeled as signalized intersections, and the factors are applied to convert the signalized intersections to roundabouts. The Crescent and 3rd Street intersection is modeled as a signalized intersection with the provided CMFs applied and is evaluated as part of Kentucky Innovation 1. The Dixie Hwy and Kyles Lane interchanges predictive safety results are summarized by intersection in **Table 47.** The predictive safety results show that introducing roundabouts at the Dixie Hwy and Kyles Lane ramp terminals and the Crescent and 3rd street intersection would benefit Build Innovations.

Figure 22: Roundabouts at Dixie Hwy and Kyles Lane Interchanges

Table 47: 20-year Predicted Crashes for Kentucky Detailed Design Modification

Alternative	Facility	Predicted Crashes: 2029-2049						Crash Cost ($ Million)
		K	A	B	C	PD	Total	
Refined Alternative I (Concept I-W)	NB I-71/I-75 & Dixie Hwy Int.	0.1	3	15	68	122	208	$7.1
	SB I-71/I-75 & Dixie Hwy Int.	0.1	2	14	63	124	203	$6.6
	NB I-71/I-75 & Kyles Lane Int	0.1	3	15	68	128	214	$7.1
	SB I-71/I-75 & Kyles Lane Int	0.1	2	12	54	103	171	$5.7
	Total	0.4	9	56	253	478	796	$26.5
Build Innovations	NB I-71/I-75 & Dixie Hwy Int.	0.0	0.8	5	21	97	123	$2.8
	SB I-71/I-75 & Dixie Hwy Int.	0.0	0.7	4	18	93	116	$2.6
	NB I-71/I-75 & Kyles Lane Int	0.0	0.8	5	22	104	131	$3.0
	SB I-71/I-75 & Kyles Lane Int	0.0	0.7	4	20	89	114	$2.6
	Total	0.1	3.0	18	81	382	484	$11.0

8. CONCLUSION

An Interchange Modification Study requires documentation that the recommended preferred alternative will not degrade the interstate system concerning operations or safety compared to the existing conditions. The purpose of the BSB IMS Addendum is to confirm that the innovation refinements incorporated into Build Innovations will not degrade operation or safety when compared to the previously approved IMS design, Refined Alternative I (Concept I-W).

This safety analysis is a component of the overall IMS documentation. It establishes a baseline of existing safety conditions by reviewing the most recent five years of crash data, specifically from 2019 to 2023. The review highlighted significant safety concerns with several freeway segments in the corridor that have been identified as priority areas by ODOT and KYTC.

These safety concerns arise because the current I-71 and I-75 facilities do not meet the current design standards for several features, including lane widths, shoulder widths, horizontal and vertical clearances, and left-hand entrances and exits. Additionally, the roadways' horizontal and vertical geometry is inadequate. Furthermore, the existing BSB was not designed to accommodate the current or projected daily traffic volumes, leading to design deficiencies and an increase in congestion-related crashes.

As established in the IMS Addendum approved in 2023, Refined Alternative I (Concept I-W) addresses the existing safety concerns. To understand the safety implications of the proposed design changes in Build Innovation, a predictive safety analysis was completed for the two build alternatives. This analysis focused on the Phase III and II sections of the BSB project limits, including the areas with design and traffic volume changes. The study indicates that the freeway mainline crashes are reduced in Build Innovations due to cross-section improvements on the Companion Bridge, amongst other design enhancements. Build Innovations has an increase in intersection crashes due to increased exposure from the removal of direct service ramps and the introduction of new arterial intersections. The analysis shows an increase in crashes on C-D roads due to design changes for Build Innovations. This increase is linked to the optimization of C-D gore locations, which has led to an expansion of C-D road length and the conversion of some one-lane C-D roads into two-lane C-D roads. These changes aim to improve operations during peak periods.

Overall, the IHSDM modeling indicates a similar level of safety between the two alternatives. The designs of the Refined Alternative I (Concept I-W) and Build Innovations follow the project's purpose and need to improve traffic flow and level of service and correct geometric deficiencies. This leads to improved safety and maintains connections to critical regional and national transportation corridors. Additional uncaptured safety benefits from operational improvements and improved vertical design throughout the project may result in additional safety benefits.

The analysis shows that the Refined Alternative I (Concept I-W) design from 2023 and Build Innovations provide improved conditions for travelers from the No Build design. This is due to increased capacity and improved traffic flow, designs that meet current standards for curves and shoulders, reduced weaving by separating mainline and local traffic, and the elimination of left exits from the freeway mainline. These improvements to safety over the No Build are similar to the Refined Alternative I (Concept I-W) and Build Innovations design.